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ASTRONOMY.

THE SUN AND PHENOMENA OF ITS SURFACE.

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I have no doubt that the sun contributes much more to all the comforts and happiness that we enjoy in life than people generally think. It is very large and very distant. Our earth is a great body, and to travel round it—25,000 miles—is a long journey. And yet this, more than three times 8,000 miles, is only one-ninth of the distance to the moon. Now if the sun were a hollow sphere and the earth placed in its center, the moon might be at its present distance from the earth and still be but slightly more than half way from the sun's center to its surface.

The diameter of this vast source of light and heat is given at 860,000 miles, and its distance at about 92,000,000.

Presuming that readers of the REVIEW already have a general knowledge of the spots on the sun, from an article on this subject in the Number for May, 1879, I will now briefly recite the more important solar phenomena as presented in my six-feet telescope during last year; and then allude to the causes of sun spots, and other matters with which they are supposed to be connected.

During 1879, I observed the sun about every clear day the year through; generally using a magnifying power of 100, furnished with a reflecting prism which admits the full aperture of the object-glass, $4\frac{6}{16}$ inches. This arrangement gives a more interesting view of the varied phenomena of the solar surface than the direct view with a common eye-piece, which requires a cap or diaphragm over the object-glass to prevent too much light and heat entering through the object-

ive. The reflecting prism is a piece of glass of such form as to allow a great portion of the sun's light to pass entirely through and out of the telescope, and still reflect enough to form a good image, and give a fine view of the solar surface. Examined in this way when the air is very clear and calm, (which, though, is rather seldom, even when no clouds are visible,) the disk presents a delicate mottled or granular appearance as though there existed many thousands of fine freckles all over the fair face of the sun. Sometimes, indeed, it seems rather difficult to distinguish between the largest of these minute forms and the least of the solar spots. Besides these freckles I sometimes notice a very white curdled or brain-like appearance—possibly masses of "rice grains," etc.—to be described further on.

In January two spots were observed in the fore part of the month; and I saw only two others—on the 30th; from which we may infer that the sun was nearly clear of spots all the month. I saw none in February till the 14th, when a small group appeared, and vanished in a few days. Except a small spot March 14th, no more were seen till the 11th of April, when a group of five little spots and bright faculæ appeared at the eastern edge of the sun. Next day the group contained sixteen spots. On the 13th nine. In one part of the group, several little spots had united into one, which was surrounded by bright penumbra. By the 16th a group of twenty-five spots had formed, seven of which were large. On 20th they were mostly gone—only one remaining. It was near 5,000 miles in diameter, and could be seen with a small spy-glass. It grew smaller, and disappeared at the western edge of the sun on the 23d. On 24th no spots, but the mottled appearance was very prominent—like innnmerable little specks over the sun's face. No more spots this month. May 6th, bright facula at east edge. Next day a group of spots appeared there. On 8th and 9th, about a dozen were seen—one of them pretty large. By 13th the group had dwindled to one little spot. No more till June 4th, and very few till 27th, when a group of fourteen spots was visible, and in three days it numbered thirty-seven. It fell off to one by July 5th. In six days a group of twenty had formed. On 13th one of them was near 8,000 miles in diameter—nearly large enough to be seen without a telescope. It was surrounded with a wide penumbra. On 14th the sky was uncommonly clear and fine, and the general surface of the sun appeared of a whitish, curdled, or brain-like appearance. By 18th the cluster had vanished.

It may be noted that the ordinary black spots never, or but very seldom, appear near the *poles* of the sun; but now one or two *white* spots were visible in the region of the north pole. On 26th the mottled and fine brain-like appearance were very prominent. August 9th, several white spots were seen at intervals *all round* the sun's margin.

It will be understood that these white spots are entirely different from the common sun spots, which are always black or nearly so. Quite a showing of solar spots occurred on the 8th to 14th of August. On 12th a large group broke out near the west edge and soon disappeared. Another spot show occurred in

the last of August. Between 8 o'clock of 28th and the same hour of 29th, a very large spot broke up and formed three smaller ones. In three or four days after this wreck in the sun, a great rain fell in our country. Very few spots in September. But a large cluster was very prominent from October 7th to 11th. In a few days other spots broke out in different places, making a speckled appearance on the sun's face. About the 21st they had all disappeared, leaving the sun clear for two weeks, and nearly so for three weeks. Toward the middle of November a large group formed and passed over the western side of the sun. A few small spots on several days in December closed the exhibition for 1879. A show of fifty-five spots in three groups occurred in the middle of January, 1880; and since that time but few days have passed without spots being present on the sun. So it is evident that they are now on the increase. And I am not sure but that it is more rapid than it was in the early part of the period which commenced in 1867. I consider that the minimum this time occurred in the early part of 1879; making the period twelve years long.

About eleven years is the average length of several former periods from one minimum to the next. The extremes are about ten and thirteen years.

Greater activity seems to prevail during the first half of the period than during the last half, so that the maximum, or greatest show of spots, occurs about two years before the middle of the period. But I am satisfied from my own observations that the maximum of the last period was near three years before the middle, particularly as regards the number. However, spots of large size continued two or three years after their number began to grow less.

In attempting to explain the freckly or mottled appearance, I would offer the one theory of its being the interstices of the darker or gray portion of the sun's surface in which a very large telescope, furnished with a polarizing eyepiece, shows "hundreds of thousands of small intensely brilliant bodies, that seem to be floating in the gray medium, which, though itself no doubt very bright, appears dark by comparison. What these little things are, is still uncertain; whatever they are, they are the immediate principal source of the sun's light and heat." They bear a certain resemblance to rice grains of different size and shape. Although these little bodies appear quite small when they are magnified even many hundred times, yet they are really hundreds of miles in extent. It is believed that these little fiery bodies collect in dense masses and form the cloud-like faculæ which often appear near the edge of the sun, and are apt to precede the formation of large spots, though not in every case. These faculæ are often so large and prominent as to be visible through a telescope of 1½ or 2 inches aperture. Huyghens said of them near two centuries ago, that they seem to be "something in the sun brighter than the sun itself."

It is now a settled belief among those who have given the subject most attention, that iron, magnesium, and other metals exist in the sun, and particularly in the region of the spots; though not in the solid state in which we know them, nor even in the melted or liquid condition, but in the form of gas, or vapor—

the result of most intense heat. Great masses, or clouds of vapor charged with these gases exhibit the most fitful and ever-changing forms which it is possible for us to conceive. Realize if you can, the effects of one of our most violent hurricane storms in which the wind travels two or two and-a-half miles in a minute, and smashes the largest buildings and trees it meets. Then picture in the mind a raging storm as much more violent than the hurricane as the hurricane exceeds a gentle breeze, and you may approach a faint idea of the wonderful commotion that sometimes pervades the surface of the sun.

When a mountain mass many hundred miles in extent, or a vast whirlpool of equal area, is actually seen to form and then scatter and disappear in less than one hour, we have strong proof of the great activity just alluded to. Mountain forms of burning hydrogen make up the rose colored prominences which nearly always exist along the edges of the sun. Before the invention of the spectroscope, these "red flames" were seen only during total eclipses of the sun. But now, this wonderful instrument shows them *any time* when they are large enough to be seen.

A solar outburst of much interest was observed by Prof. C. A. Young, of Dartmouth College, in 1871, September 7th. On that occasion he saw what seemed to be tongues or filaments of burning hydrogen shoot up from a great prominence whose height was already 100,000 miles, to an elevation of 200,000 miles—having made the hundred thousand miles in ten minutes—denoting a velocity of 167 miles per second.

I understand the Professor, as well as R. A. Proctor, of England, to entertain the idea that the internal forces of the sun are sufficient to, and possibly do, eject solid matter from the sun's interior never to return; and that "it is by no means impossible that some of the specimens of meteoric iron in our cabinets are really pieces of the sun." Whether or not this theory is tenable, there is no want of evidence that most astonishing forces do exist in the sun.

The general theory of sun spots, as I understand it, is, that amid the mighty rush of torrent vapors great rents or openings are made in the photosphere (outer visible surface of the sun) extending deep in the sun's interior; and that a spot is simply a black and vacant space—the "central darkness" of a solar whirlpool. In regard to the cause of solar spots, etc., I wish to introduce another paragraph from C. A. Young: "What are the causes of such eruptions it is impossible to state as yet with any certainty; still, knowing what we do of the enormous amount of energy which the sun is continually pouring out in the form of heat, it is nothing strange that such things should occur, and that on a solar scale."

A feature of much interest in connection with sun spot periods is their correspondence with similar periods of Aurora Borealis, and magnetic force of the earth; the greatest prevalence or maximum of each one accompanying that of the other. A noticeable instance of this occurred in 1859, September 1st. Two observers in England were examining a large group of sun spots at the same

time, when they noticed an amazing outbreak of "two patches of intensely bright white light in front of the spots." These dazzling patches continued visible near five minutes, during which time they passed over a space of 33,000 miles. At the same moment (as was afterward learned) a noted disturbance occurred among the magnetic instruments at the Kew Observatory; and in sixteen hours a magnetic storm set in, which not only impeded communication by telegraph, but set fire to some of the offices. I well remember seeing brilliant Auroras on several nights at and near that time.

The following points, I think, are less entitled to acceptance than the one just mentioned. The theory that Jupiter and Venus exert an influence in the production of sun spots and their periodical occurrence, seems to me very much like that of the moon exerting an influence on the weather, the growth of vegetables, etc.,—one in which I have but little confidence. Looking at the very face of the matter it seems much more probable to me that the gigantic powers of the sun would produce the comparatively feeble magnetic and electric phenomena of the earth, than that Venus and Jupiter in any position they can have, would produce the raging forces in the sun, or even change their directions. A. Elvins, an observer of Canada, gives the opinion that years of sun spot maxima and minima are generally more cloudy than the intervening years. My own observations hardly confirm this view. So with his conclusion that greatest and least show of sun spots have less rain and more cold than other years. Mr. Elvins, with one or two other investigators of these subjects, decide that cylones and heavy storms generally occur in about two years after a sun spot maximum. This is doubtless correct. But our cylones occur so frequently in other years, and even during sun spot minima, that I fail to see the foundation of a law in *this* point. But their idea that both the maxima and minima of spot frequency are immediately preceded by *very wet* years, or season, I find to be true in most cases that I have examined.

And yet, as regards nearly all the above subjects, I heartily endorse the following sentiment put forth by Arago: "In these matters we must be careful not to generalize till we have amassed a large number of observations."

The sun is a great body, and I am sure that the hidden source of its wonderful energies is the Almighty Hand which created and governs the whole universe.

THE GREAT SOUTHERN COMET.

The interest of the astronomical world was suddenly awakened early in February by a telegram from Dr. B. A. Gould, at Cordoba, to Prof. Peters, of Kiel, stating simply that there was a great comet passing the sun northward. This, together with the announcement of Dr. Gill, of Cape Town, a few days later, which, from the lack of unity in the system of signalling astronomical discoveries, could not be determined to be the same one, caused an amount of excitement among amateur astronomers that is quite unusual. Sufficient facts have not been as yet determin-

ed to render a thorough discussion of the comet possible, but nevertheless it is none too early to begin the accumulation of such facts, as this may at a later time be a much more serious undertaking. The story of the discovery of Comet I. 1880, is given in an extract from a letter from Dr. Gould to Prof. Peters, which is in the *Astronomische Nachrichten*, No. 2303.

On the evening of February 2, Dr. Gould saw, during twilight, a bright streak of light in the southwest, which he immediately supposed to be the tail of a huge comet. An attempt to sketch the object was made, but, owing to the murkiness of the sky, it was unsuccessful. The approximate position of this streak of light was from R. A. 22h. 40m.— 45° to less than R. A. 23h. 0m.— 50°. On the 3d of February, the object appeared somewhat brighter, and had moved northwards throughout its entire length, and was evidently the tail of a comet which seemed to be approaching perihelion. All attempts to detect a nucleus were unavailing, and the equality in the brightness of the tail throughout its visible length of fully 40° and the remarkably small decrease of its breadth toward the horizon prevented any safe conjecture as to the position of the nucleus. On the 4th, the comet seemed to be a little brighter, and the tail preserved the same peculiarities as before, and in brilliancy was in no part equal to the milky way. This evening, Dr. Gould observed what he considered to be the head of the comet, which through the haze and twilight appeared to be a coarse, ill-defined mass of dull light, some 2′ or 3′ in diameter and without any visible nucleus.

Observations made by Mr. Gill, at the same time, are noted in the *Observatory* for March, although not fully. Among the early newspaper items may be quoted that of Prof. Peirce, who lost no time in comparing the data of Gould's comet with those of the comet of 1843, and announced himself as fully persuaded that it was a return of the earlier comet.

Quite early in the field was the Observatory of Rio Janeiro, the Director of which, Prof. Liais, in the *Astronomische Nachrichten*, No. 2304, under the date of February 20, makes a report of the same. At Rio, the weather was unfavorable, and, save the 4th and 8th of February, the comet was not observed. In other parts of the Empire, however, observations had been made sufficiently numerous to justify the statement of an approximate orbit, which, in view of later data, it is not necessary to give in detail.

According to *Natnre*, No. 540, Mr. Gill saw the tail of the comet even as early as February 1. No. 541 of the same periodical contains an extract from a letter by Mr. Gill, specifying his observations up to the 9th of February. As Table Mountain interfered with the view of the comet from the Royal Observatory at Cape Town, Mr. Gill went over to Seapoint, on the west side of the mountain, and sketched the position of the tail, on several evenings. The next issue of *Nature* contains elements of the comet, by Mr. Gill, which, however, may be considered as in error, in consideration of the elements given in No. 544 of the same periodical. These elements were computed by Mr. Hind from the

observation of Dr. Gould on February 4, and from rough places communicated by Mr. Gill. These elements are as follows:—

COMET I. 1880. GOULD.

Perihelion Passage, January 27. 6027.

	G.	M.	T.
Long. Perihelion,	279°	6′.8.	
Long. Node	4°	1′.9.	
Inclination	35°	39′.8.	
Per. Distance	0.0059390.		
Motion, Retrograde.			

According to the same periodical, the comet was observed from H. M. S. "Triumph," while at sea, between Payta, in Peru, and Manta, in Equador, on the night of February 7. The nucleus was seen at this date, and the comet was again observed on the 8th and 9th.

According to the *Observatory* for April, the comet was so faint on the 23d of February that Mr. Gill conld not discern the least trace of it, there being strong moonlight, however.

As has been stated, Prof. Peirce was very early in the field with an assertion that this comet was a return of that of 1843. and in this his judgment has not been at fault, for, taking either the elements of Mr. Hind or those which may be considered as the next most authoritative, the resemblance is altogether too close to be the result of accident. The elements of the comet of 1843, as computed by Hubbard, were —

Long. Perihelion	278°	35′.1
Long. Node	1°	20′.6
Inclination	35°	38′.2
Per. Distance	0.005511.	
Motion, Retrograde.		

In view of thc relationship, a few notes on this great comet—which, says Cooper, in his Cometic Orbits, has been considered the most interesting of any on record—may be acceptable.

Prof. Peirce, in the note to the *Boston Advertiser*, already referred to, gave as his opinion that Dr. Gould's comet is that of 1843, and has been seen before in B. C. 1770, 370, 252, 183, and A. D. 336, 422, 533, 582, 708, 729, 882, 1077, 1106, 1208, 1313, 1362, 1382, 1402, 1454, 1491, 1511, 1528, 1668, 1689, and 1702.

"In 1843," says Prof. Peirce, in a lecture on comets and meteors, "at about noon on the 28th of February, people in New England were able to see a brilliant object close to the sun. Such a marvelous spectacle had never before been seen. Accurate and reliable observations of its position with regard to the same were made. A week later, a wonderfully brilliant tail of a comet was seen skirt-

ing the horizon just after sunset, reaching one-third of the way around. At perihelion, it was nearer to the surface of the sun than any known comet, save that of 1680, and both of them swept in nearer than the solar corona."

It was estimated by Newton that the comet of 1680 was subjected at perihelion to a heat equal to 2,000 times that of red-hot iron.

The discussion of this comet made by Prof. J. S. Hubbard, and published in Dr. Gould's *Astronomical Journal*, Vol. i., is pre-eminently the authority concerning it. Much difficulty was encountered in an attempt to fix its orbits, owing to the shortness of time for observation, proximity to the horizon, and the slowness of its motion. The peculiarity producing the most remark was the smallness of its perihelion distance, resembling the comet of 1680, while its physical characteristics resembled the comet of 1668. In concluding his discussion (Vol. ii.), Prof. Hubbard states as follows:—"So far as the data employed and the calculations based upon them can be relied upon, the hypothesis of the identity of this comet with that of 1688 is not sustained." The probable error of a single observation of his computed orbit was determined by Hubbard to be $= \pm 10''.62$, and considering also the probable error belonging to an orbit of 175 years, the difficulty stated by Nicholai shows itself, viz.: that "the transition from a period of 175 years to one of infinity, makes almost no difference in the representation of observations." So small a portion of the orbit is it within our power to observe, that the differences in the observations upon a long orbit and those on an infinite curve are extremely difficult of determination. In the consideration of the comet of 1880 and its discussion, the observations made in 1843 may be of the greate importance.—*Science Observer.*

CORRESPONDENCE.

SCIENCE LETTER FROM FRANCE.

ATMOSPHERIC DUST—KLEPTOMANIA—HUMAN HEAT—PHOSPHORESCENCE.

PARIS, April 13, 1880.

The Scientific Association of France has resumed its instructive Saturday Evening Conferences at the Sorbonne, our Royal Institution, under the presidency of the celebrated and indefatigable M. Milne Edwards. The subjects selected are of every day, living interest, are the specialty of each lecturer, and are handled in a popular manner and illustrated with every suitable apparatus. M. Jamin has expounded the latest discoveries in telephones and phonographs; M. Egger has deciphered the recent papyrus finds in Memphis; M. Bouley has examined the question of rabies, and M. Gaston Tissandier, of elevated ballooning notoriety, has revealed many interesting facts on atmospheric dust, its connection with cosmical matter, and the important rôle it plays in fermentation and

decomposition. As the air is purer after being washed by rain, so in dry weather and especially in cities, the atmosphere is a veritable dust-bin; we are sensible to the existence of these particles of attenuated matter; in breathing them they disgust us, and in falling and remaining on clothing and furniture they demonstrate not only their presence but their plenitude. Admit a sunbeam into a darkened room and the molecules will be revealed like nebulæ; yet the numbers we perceive, are perhaps but the minimum of what exists, for after the naked eye and the microscope there are minutiæ which dance still. Much of this atomic debris is of inorganic origin, and a great deal is derived from animal and vegetable sources; the renowned experiments of M. Pasteur have demonstrated, that among these atomies which live, move, and have their being in the air, are germs or spores of fermentation and decomposition, that is to say, the seeds of disease and death. Showers of dust impalpable as flour, and sometimes red as blood, have fallen in several parts of the world, astonishing or frightening, as the populations are superstitious or cultivated; these showers are simply silicious particles whipped up to the superior regions of the atmosphere, and driven along by aerial currents; such particles have been lifted in Guiana and showered on New York, the Azores and France, as Ehrenberg detected therein animalculæ and shells, peculiar to South America. Over the summits of the high mountains of the latter country, the atmospheric currents are ever charged with silicious powder, and in parts of Mexico, the crests of mountains act as veritable bars, and compel the deposition from these air streams of the dust, and which accumulate in the valleys to the depth of ninety yards. Geology recognizes these atmospheric deltas. The foam of waves as they dash against the coast, is pulverized into feathery pellicles, which float sky-ward with a trace of saline matter and that a sea breeze carries far inland. Space contributes as well as earth and ocean to the production of aerial dust; when meteorites and falling stars are rendered luminous and incandescent by their rubbing against strata of air in their vertiginous flight, they part with quantities of their metallic elements in the form of powder, iron, nickel, and cobalt, substances that Nordenskïold has gathered on the virgin snow of the Polar regions. When atmospheric dust, whether collected directly on a sheet of paper, or from the sediment of snow and rain, is probed by a magnet, the tiny particles of iron attracted, have all a spheroid family likeness, resembling furthermore iron filings if melted in a flame of hydrogen or the extinguished sparks that fall on striking an ordinary flint and steel. Nay more, similar atoms of meteoric iron have been traced in the Lower Lias formation, geology thus affording evidence, that as now, so before the appearance of man on earth, atmospheric dust existed. The air is a vast store house of animalcules; expose a solution of some organic substance to the atmosphere for twenty-four hours, it will be speedily inhabited by myriads of infusoria, rolling and tumbling, yet so small that hundreds of them if placed in a row would not form a line in length. These worms resemble little eels. Analogous animalcules induce decomposition and fermentation, for the latter cannot take place unless the organic matters be in contact with the air, to receive the

seed of the leaven, which by cellule propagation leavens the whole mass. It has lately been shown that the process of nitrification in certain soils is due to a peculiar ferment, that is to say, to a spore floating in the atmosphere, and finding its conditions for action, stops and operates. Marsh fever is due to cellules or spores existing in a bog neighborhood; the same spores have been detected by the microscope in the expectorations of the patient, in the dew that was examined, and on the surface of the peaty soil where they were generated. This is simply poisoning; to a like cause is due the fell disease known as hospital gangrene, the germs in the polluted ward-atmosphere, enter the wounds, induce putrifaction, and death. Hence the importance of washing the affected part with carbolic acid or other anti-septic; then dressing it with a wadding that will intercept, by acting as a filter, the germs to be deposited, from being sown. In many factories workmen become victims to the dust, generated by their special industry, entering and saturating the lungs; on dissecting old colliers, their lungs after forty years respiration of dust, instead of being rose-colored as in health, were as black as the coal itself; the dust in this impalpable form is often the cause of accidents; it can take fire and blaze like alcohol. Witness the catastrophe at the Minneapolis flouring mills; the confined air highly charged with the flour, became on a par with ether or alcohol, awaiting only ignition from the heated millstone to burst into flame and explode.

The Society of Legal Medicine has discussed the question of shop lifting; no very clear results have been arrived at; it was maintained that in the case where the accused female's family was liable to hereditary cerebral irregularities, the court ought to accept such as an extenuating circumstance. It seemed to be the opinion, that too much importance was attached to the abnormal inclinations and fancies of women *enceinte*, and also, that the interests of justice were not served by the numerous classifications that alienists indulge in. Dr. Lassègue repudiates all the doctrines about monomanias; a woman shop-lifts because she has not the strength to resist, and if any obstacle rises up to baulk her thieving, that chance will save her, as reason does in the case of others. He disbelieves in the theory of excitement; the seduction is not greater than what other females experience at the view of articles of toilet; it is transitory, and the thief speedily forgets not only the pleasure she anticipated from possessing an object easily obtained, but the fault itself. He concludes, the less the impulsion of the weak-minded will be imperious, the more she will be encouraged by every attraction—that of impunity included.

M. Hirn has devoted a good deal of attention to the subject of human heat, and in his experiments has been assisted by Professor Herzen, of Florence. Heat, or caloric, is synonymous with force, and there ought to be a gain or loss of heat, following the nature of the work. For example: the exertion to raise our own weight in ascending a stair-case, or a mountain, must represent a loss as compared with descending either. Now, M. Herzen affirms in both cases the contraction of the muscle is almost the same; there is only a slight difference in the intensity

of the contraction executed, but none in point of view physiological. From the moment there is no external work, there is no consumption of heat; when a muscle contracts, there is a diminution of temperature, and deoxidation. Following the contraction or expansion of the muscles, the physiological actions will vary: a Swiss guide will ascend a mountain, carrying a burden, without manifesting fatigue; but perspiration will be more or less intense; the pulse and respiration will be accelerated; the panting will be more or less sensible, following the robustness of the individual. These phenomena will be less during the descent. Does intellectual work consume or produce heat? No, according to M. Hirn, the course of our thoughts modify at each moment the march of the organic functions; each feeling of joy, of sadness, of pain, of fear, or of agony, determines special modifications in the rythms of the pulse, of respiration, etc.; nervous persons know how each emotion may create muscular tremblings, and active heart-beatings; intense and sustained intellectual work often produces cutaneous transpiration, amounting to positive perspiration. Is there no loss of heat in this case? None, because the labor is internal, and has nothing in common with external manual work; but the intellectual exertion can influence the nature of the materials that oxygen burns, during the process of respiration; it can modify the employment of oxygen, and thus change the conditions of combustion.

M. de Bellesme has been studying the phosphoresence of the glow-worm, from the physiological side; he substituted for the will of the insect, an electric current, and was thus enabled to produce the luminousness desired. He ascertained, and so corroborates Matteucci, that the presence of oxygen is indispensable to the production of phosphoresence, hence, there is in the luminous organ the production of a matter, which, in combination with the oxygen of the air, produces light; the structure of that organ excludes the possibility of all secretion, liquid or solid, for the matter is gaseous, and only phosphuretted hydrogen is glowing under ordinary conditions. Not only is there no phosphorus accumulated in the organ, but there is no provision of matter at all. M. de Bellesme has demonstrated conclusively, that the luminous substance is produced in proportion as it is required—never accumulated; that phosphorescence is a general property of the protoplasma, the result of phosphuretted hydrogen produced therein by chemical decompositions in connection with the cellules of the organ; the decomposition in the case of the glow-worm, being under the nervous influence of the insect, and which is essential for setting free the phosphorescence.

The estimation of the quantity of cream contained in milk can now be made very accurately and rapidly, by means of centrifugal force. Attach the handle of a can, filled with milk, to a cord; hold the other extremity of the latter in the hand, and twirl as if for a sling; the cream, lighter than the rest of the milk, will accumulate on the surface free from all liquid, and more quickly than if in a state of repose; the time will even be lessened in proportion as the revolutions are rapid. When the milk has a temperature of 59 to 68 degrees F., the separation of the cream takes place in fifteen minutes, at the rate of 600 revolutions per

minute. At the same time the quantity of water added to the milk for adulterating purposes can be ascertained. M. Gembloux having tested that pure milk contains 10 per cent. of cream, added one, then a second tenth, of water, and when whisked, the cream represented but nine and eight per cent. of the volume of milk. Further, when whirled in the cylindrical churn, the contents formed three distinct layers—cream, water, and skim-milk. The same centrifugal test was applied to butter, maintained in the liquid state by means of hot water; the matter separated into three states toward the circumference of the churn—fatty butter, caseine, and salt water; it was in the latter all the mineral adulterations lodged. It was at the Exhibition of Vienna that an apparatus for separating cream from milk by centrifugal action, was first made known: it is to M. Lefeldt that the honor reverts for applying the system on a vast scale by means of a turbine cylinder making 800 rotations per minute, when the cream is formed round the axle of the machine, after which comes the skim-milk, and then the impurities, forming, as it were, three rings or zones. Other skim-milk is introduced, which forces up the cream to run over, and thus out of, the cylinder. M. Lawal's Swedish skimmer is so constructed, that in proportion as the cream and skim-milk are separated, they pass off by the entrance of fresh milk. In the co-operative dairy at Kiel, 4,000 quarts of milk the produce of 550 cows, are centrifugally skimmed per day.

M. Forel's experiments on Swiss Lakes prove that cold can penetrate therein to the depth of 120 yards.

M. Nordenskjold has stated, in a letter to M. Daubrèe, that judging from his dredgings in the Siberian Sea, the fauna most rich in individuals, at a depth of from 33 to 110 yards, does not exist between the tropics, but in the Glacial Ocean and the Behring Sea, where the temperature, too, remains at the bottom, from 30 to 28 degrees F. The municipality of Paris intends receiving and honoring M. Nordenskjold in the name of French Science. F. C.

PSYCHOLOGY.

THE SOUL—WHAT IS IT?

Concerning the constitution of man there are three distinct theories. The first regards him as composed simply of a body, actuated for a time either by the ordinary forms of energy or by some modification thereof not yet recognized, and as losing at death his personal individuality. The second and more popular view acknowledges in him a double nature, comprising, in addition to the palpable, ponderable, and visible part or body, an invisible and immaterial principle, known promiscuously as "soul" or "spirit." But there is yet a third theory, which con-

siders man as a threefold being, made up of body, soul, and spirit. It is no part of our present purpose to define the exact sense in which these last two terms are used. It may suffice to say that by the ordinary advocates of the triplicity of human nature the "soul" is supposed to be the purely immaterial element, whilst the "spirit" forms a connecting link between the two, and, if not purely incorporeal, possesses none of the ordinarily recognized properties of matter.

An author* whose speculations we are about to examine, exactly reverses these two terms, and looks upon spirit as a something absolutely immaterial and transcendent, whilst the soul, the seat of the will, the passions and emotions, is perceptible by one, at least, of our senses, and is even capable of being experimentally isolated and obtained in solution.

We find ourselves confronted by a number of facts, hitherto without explanation and without connection. Among these must rank the phenomena of sympathy and antipathy as between different individuals, human or brute. On first meeting with some person of whom we have no previous knowledge, we often experience a strong liking or a violent dislike, for neither of which we can render any definite reason. As a rule women and children are more frequently impressed in this manner than are adult men. It very often happens, too, that if we suppress and overcome these sudden prepossessions, we find in the end that they were justifiable, and that second thoughts were not best.

Further, the emotions and passions of men assembled together are infectious, passing from one to another more rapidly than bodily diseases. From one or from a few energetic individuals enthusiasm may be diffused through a senate, a regiment, or a ship's crew. On the other hand, a few terrified or bewildered persons may spread a panic among thousands. It is commonly said that emotions propagate themselves, but we wish to know in what manner and by what means this is effected. * * * * * * * * * *

We find, again, sympathies, and especially antipathies, which may be traced between entire species of animals, and which some of us seek to explain by the indefinite and long-suffering word "instinctive." If a dog has been stroked with a gloved hand, and if the glove is then held to the nose of a young kitten, still blind, the little creature begins to spit in anger. How is this fact to be explained? The kitten has never yet seen a dog, but in the mere odor it recognizes a hostile element. Heredity? True, but how is the antipathy handed down from generation to generation? By what sign does the blind animal detect the presence of an enemy?

There is still a further phenomenon which may be looked on as a heightened antipathy—fascination. We all know that very intense fear, instead of prompting to flight, may paralyse. * * * * * * *

Taking a general view of all these phenomena, in so far as they are actually established, it would seem that animals, including man, must throw off from their surfaces some emanation capable of acting upon other animals and men with whom they come in contact or in near proximity. This supposed emanation may vary

*Professor Jager.

in its character in one and the same individual, according to its psychical condition. If the vapors or gases thus emitted by two animated beings are in harmony, the result is sympathy or attraction. If they disagree, the consequence is antipathy, showing itself as hatred in the strong and as fear in the weak. This, it will be doubtless admitted, is a possible explanation of some of the phenomena above noticed; but is it the true or the only one? Do such emanations really exist? It is, we think, certain that many animals become aware of the presence either of their prey, of an enemy, or of a friend, by the sense of smell, even at very considerable distances. Our lamented friend Thomas Belt was led to the conclusion that ants are able to communicate with each other by means of this sense, and have in fact a smell-language. Unfortunately the sense of smell is so weak in man that it becomes very difficult for us to decide.

Prof. Jäger holds that certain decompositions take place in the animal system in strict accord with psychic changes. All observers, he tells us, agree that muscular exertion effects but a very trifling increase of the nitrogenous compounds present in the urine. On the other hand, Dr. Boecker and Dr. Benecke* have proved that intense pleasurable excitement effects a very notable increase of the nitrogenous products in the urine, derived, as a matter of course, from the decomposition of the albuminoid matter in the system. Prout and Haughton have made a similar observation concerning the effects of alarm and anxiety. Hence, therefore, it would appear that strong emotion involves an extensive decomposition of nitrogenous matter, and in particular of its least stable portion, the albuminous compounds. But does the whole of the matter thus split up reappear in the urine? Prof. Jäger thinks that a portion escapes in a volatile state, forming the odorous emanations above mentioned. *This portion he considers is the soul*, which exists in a state of combination in the molecule of the albumen, and is liberated under the influence of psychic activity. Hence his soul, like the body, is not a unitary entity, called once for all into existence, but is a something perpetually secreted, and as perpetually given off. It pervades the entire system. Each organ has its distinct psychogen, all of which, however, are merely differentiations of the one primary ovum-psychogen. Further modifications take place from time to time, in accordance with the mental condition of the man or other animal. It will here be remembered that, according to Haeckel ("Die Heutige Entwickelungslehre in Verhältnis zur Gesammt-wissenschaft"), all organic matter, if not matter altogether, is be-souled. Even the "plastidules"—the molecules of protoplasm—possess souls.

In support of the assumption that a volatile something is given off from albumen, Prof. Jäger gives the following delicate experiment:—If we prepare, from the blood or the flesh of any animal, albumen as pure as possible, and free from smell and taste, and treat it with an acid, there appears a volatile matter which is perfectly specific, differing in the case of each animal species. But this odor varies according to the intensity of the chemical action. If this is slight we perceive the specific "bouillon odor" which the flesh of the animal in question gives

*Pathologie des Stoffwechsels.

off on boiling. On the contrary, if the reaction is violent, the odor given off is that of the excrement of the species. Here, then, we have the two main modifications of psychogen, the sympathetic and the antipathetic form.

Dr. O. Schmidt, Professor of Chemistry and Physics at the Veterinary College of Stuttgart, has repeated these experiments upon the brains of animals. The odoriferous principle is here evolved much more easily than from egg albumen. Immediately on the addition of an acid an offensive odor appears, which vanishes as rapidly, and cannot be caused to reappear. Nor has it been found possible to elicit from brain the more agreeable odor.

It will doubtless be granted that certain yet unexamined specific odors are given off by living animals; that these odors may be repulsive or attractive to other species; that they may be liberated more abundantly under mental excitement. But where is the proof that these odors are the soul in any condition? May they not be regarded merely as an effect which psychic emotion, along with other agencies, produces in and upon the body?

We will, therefore, though not without misgivings, quote an experiment to which Duntsmaier attaches much importance. He placed in a large wire-work cage a number of hares, and allowed a dog to run around this prison, snuffing at the inmates, and attempting to get at them for about two hours. It need scarcely be said that the hares were in a state of great terror. At the end of that time the dog was killed; his olfactory nerves and the interior membranes of the nose were taken out with the least possible loss of time, and ground up in glycerin. The clear liquid thus obtained contained the souls of the hares, or at least portions of them, in an intense state of painful excitement. Every animal to whom it was administered, either by the mouth, or by injection under the skin, seemed to lose all courage. A cat after taking a dose did not venture to spring upon some mice. A mastiff similarly treated slunk away from the cat. Now we are here confronted by a serious difficulty: if a second dog was rendered timid by merely a small portion of this extract of fear, how is it that the first dog, after snuffing up the whole, did not suffer the same change and become afraid of the hares?

Other experiments, we are told, were tried with analogous results. Thus a glyceric extract of courage was obtained from a young lion, the olfactory nerves of a dog being again used as the collecting medium.

A difficulty which must make us hesitate before ascribing animal antipathies to some disagreement in their souls, making itself known by their specific emanations, is the following: the animals of uninhabited islands when they first come in contact with man entertain no antipathy for him, until his propensity for indiscriminate slaughter is learnt by experience. Can we assume that his emanations have changed in the meantime? Again, a colony of mice had established themselves at the bottom of a deep mine, doubtless to prey upon the provisions, candles, etc., of the workmen, and had flourished there for many generations. One of them, being captured, was brought up, placed in a cage, and shown to a cat. The cat prowled around and tried to get at its prey, but the mouse gave not the

least sign of alarm. Why should the emanations of a cat be less alarming to this mouse than to any other? Is the tiger, our natural enemy—which, according to Prof. Jäger, bears the same relation to us which a cat does to a mouse,—any more offensive to us than certain animals which never prey upon man at all, such as the polecat or the skunk? If the timid man tempts the dog or the ox to attack him, on what principle does he diffuse panic among his feliow-men?

In short, Prof. Jäger's theory is beset with many and serious difficulties. Nevertheless, or, rather the more, we consider it entitled to a careful examination, both as regards its conclusion and the phenomena upon which it is based; the science of odors has yet to be constituted, and we are convinced that it will amply repay the needful trouble.—London *Journal of Science.*

SCIENCE AND SPIRITUALISM.

The recent publication of Professor Zollner's work in Germany, the death of Serjeant Cox, a distinguished lawyer and spiritualist in England, and the extended publication of Mr. Joseph Cook's lectures in this country have manifestly awakened a new interest in the alleged phenomena of what is called "spiritualism." So many communications have come to us from all parts of the country, the writers earnestly inquiring "why scientific men do not investigate the subject fully, and *settle* it once for all," that we are led to allude to the matter briefly.

In the first place, we will say that scientific men *have* investigated it, and published the results of their labors. In England, three representative men of the highest distinction, Wallace, the naturalist, Varley, the electrician, and Crookes, the chemist, have given the subject thorough experimental examination. Crookes devoted *four years* to the labor, Varley *seven*, and Wallace *ten*, and they state in the most decided manner that the alleged phenomena are actual and real. All these scientists are Fellows of the Royal Society, and they represent three of the most important departments of physical and natural science, chemistry, electricity, and biology. In Germany, five of the renowned professors in the universities, with Zollner at the head, have laboriously investigated the problem, and they also avow belief in the verity of the phenomena. In Russia, Wagner and Butleroff, professors in the University at St. Petersburg, after years of patient investigation, have reached similar conclusions. In addition to those named above, Dr. Franz Hoffman, of Wurtzburg University, Camille Flammarion and Hermann Goldschmidt, distinguished astronomers, and a large number of other scientific men in Europe, noted for accuracy of research and great acquirements, render the same affirmative verdict. In this country, the late venerable Dr. Robert Hare, of the University of Pennsylvania, gave five years of experimental labor to the subject, and he also became a convert. With him may be counted, perhaps, twenty other students in science, of less note, who coincide in his views.

Let us look at the other side. In England, three distinguished representative

scientific men, Tyndall, Huxley, and Carpenter, entirely dissent from the conclusions and views of the three others named. Tyndall speaks of the "intellectual whoredoms of spiritualism." Huxley asserts that he "should have no interest in it if it was true." Carpenter, in a spiteful way, designates as "fools" all who take the trouble to look into the matter; and oracularly declares that "the whole thing is nothing but *unconscious cerebration.*" All of these gentlemen, like the others, are Fellows of the Royal Society.

In Germany, Zollner meets with a strong adversary in a distinguished professor in another university, who has written a "counterblast" to Zollner's book. The great naturalist, Carl Vogt, dissents, and so do Haeckel, Buchner, and Rolle. In this country, Agassiz was incredulous of the whole thing, and so, it would appear, are a large majority of the notable men connected with our colleges and universities. But it is quite impossible to learn the truth in this regard. A considerable number, as we personally know, express views in private which they are careful not to make known in public.

From the above brief review it will be seen that "spiritualism" in this country and Europe is regarded, among scholars and investigators, with about the same diversity of views as "Darwinism." On this continent the great names of Dana and Dawson, with numerous others, are counted as disbelievers in Mr. Darwin's theories; on the other hand, the young naturalists, with America's distinguished botanist, Professor Gray, at their head, incline to adopt his conclusions. In Europe about the same remarkable diversity in opinion is found among the great scholars and experimenters.

There is hardly any theory or doctrine in science upon which learned men are perfectly agreed, and it is not probable that this conflict of opinion will end very soon in regard to spiritualism or Darwinism. Whilst it is true that in investigations which so completely baffle the ordinary observer the thorough scientific man has a great advantage, he is still warped by prejudice, and there cling to him certain weaknesses common to humanity under all conditions. He is apt to adopt Faraday's views: "Before we proceed to consider any question involving principles, we should set out with clear ideas of the naturally possible and impossible." If we are to investigate nothing till we know it to be *possible*, the boundaries of the field of investigation become narrowed almost to a point. The notion is absurd. Nature is chary of her secrets, and we are not permitted to have any very clear ideas of what is *impossible*. Doubtless those who have investigated the subject under consideration have entered upon the work with all the prejudices and doubts natural to labor in such a field of mist and darkness, where tricks and fraud may be presumed to hold sway. The conclusions reached in the aggregate have been so conflicting that, so far as the world goes, nothing has been settled, and we do not see how it can become a clear matter of belief or disbelief among all classes from any investigations that may be undertaken, no matter how learned or exalted the individuals may be who enter upon the labor. To be sure, spiritualism rests upon alleged physical occurrences and facts, and

so does Christianity, but science is incompetent to convince the world of the truthfulness or falsity of the later as well as of the former. Seeing is not always believing, and the most obstinate disbelievers in experimental results are among the co-laborers and associates of those who bring forward alleged results for consideration. Especially is this the case among those whose prejudices run counter to facts sought to be established.—*Boston Journal of Chemistry.*

ANTHROPOLOGY.

TERTIARY MAN.

TRANSLATED FROM THE FRENCH OF ZABOROWSKI, BY E. L. BERTHOUD, A. M.

"How far in past geological ages can we demonstrate the existence of man? We have to-day all necessary elements to give a satisfactory answer to this question.

Already in the beginning of 1864, M. Garrigou believed that he had proofs of the contemporaneity of man and miocene mammifers.

These proofs were bones of Dicrocerus Elegans, broken exactly like those from the quaternary caverns of France. Those bones came from the hill at Sansan, Department of Gers. Submitted to scientific discussion in 1868, this proof made no sensible impression. Nor did the so-called notches on a rhinoceros' jaw observed by Col. Saussédat from miocene strata at Billy, in France, obtain any greater credence.

M. Delaunay reported his discovery of incisions observed by him on the fossil ribs of a Haliterium obtained from the miocene cliffs of Pouance. These, for a long time, were attributed to the action of man. But in 1873, this position was abandoned by Delaunay and his follower, L'Abbe Bourgeois, and the incisions, on the advice and proof M. Hébert, were attributed to a shark, the carchorodon megalodon, that had probably once gnawed them when yet fresh. These fossils can to-day be seen in the museum of St. Germain.

Generally, the only objects incontestably of the miocene epoch, which bear traces of marks actually formed by the intervention of human agency, are the chipped flints of Thénay in the Department (Loire et cher.) These have been gathered by M. Bourgeois at a great depth in the ground, under a more recent deposit that yielded polished implements of flint. All these being in a much more recent quaternary stratum, while under them were miocene layers containing abundant fragments of haliterium, mastodon, acerotherium, etc.

The rough flint tools consist of scrapers, reamers, and small flint points, but all so roughly fashioned that everybody hesitated for a long time to take them for flint chippings, designedly so chipped.

M. Bourgeois presented the first ones found, to the congress of 1867. A few scrapers were then admitted to have been fashioned by human design, among those so agreeing being Messrs. Mortillet and Hamy. But when in 1873, M. Bourgeois presented some more new specimens found by him, to the same congress, opinions of their being the work of human hands, were much divided. But the scrapers were, however, recognized as genuine, some of them even presenting not only marks of fire, but have been shaped by aid of fire, the chipping having been employed only to correct the action of heat, and to modify the rough burnt forms.

M. Mortillet, after this, formed of this epoch of the first recognized human labor, the epoch of the "astonished stone"—in French, "Pierre etonnee,"—*i.e.* astonished or split up. Some of the flint tools are deeply altered and seamed by this action, nevertheless we can not admit, except with repugnance that the beings who constructed these flint chippings, were masters of fire, and capable of lighting it, if even of using it.

Were these beings in fact what we might call men? This question has been examined and discussed in all its different bearings by Messrs. Mortillet, Hovelacque and Gaudry, the Paleontologist, and decided by them in the negative.

It is known that animated beings on earth have followed a regular ascending scale, their most perfect developed forms, appearing in the order of succession as a development of former inferior types.

In all paleontological series, we do not see one group of highly organized beings appear on the arena before the appearance of an inferior ancestral group.

Hence, this law by no means would prevent us from considering the makers of the flint tools of Thénay, to be considered "a priori" as human beings.

The principal types of monkeys were already in existence in the middle miocene epoch; the single species of which numerous remains are now known is the "Mesopithecus Pentelici," from Greece. This simian was highly developed, and comes from the upper miocene.

M. Lartet has discovered two anthropomorphous monkeys in the middle miocene. Hence, an ancestrial form nearly human, could very well have appeared in this same miocene epoch without interfering with the laws of evolution. But there is not in the whole middle miocene, one species of mammifer identical with present species.

All species of animals and plants have been changed on earth since that period, and there is nothing startling in this when we reflect on the enormous period of time that has elapsed since the middle miocene period.

The Thénay flints occurred below strata that are middle miocene, that is the "Calcaire de Beance," then after this we have the upper miocene of Pikermi and of Vancleve; then we have the lower Pliocene; then follows the submerged forest bed of Cromer, in England; then above that the period of glacial boulder clays, of Norfolk; this to be followed by diluvium; then follows the Reindeer period; lastly our present age, "(Gaudry.)"

Since the end of the lower miocene, the mammalian fauna has been renewed at least three times, and between middle miocene and our present period there have been not only specific differences, but also generic differences.

(*To be continued.*)

A BURIED RACE IN KANSAS.*

BY JUDGE E. P. WEST, KANSAS CITY, MO.

Mr President, Ladies and Gentlemen:

I have the honor this evening of presenting to the Academy some additional facts hastily gleaned, upon a subject heretofore partially considered, and which tend further to strengthen the growing belief that a field, until recently considered barren in archæological remains, promises now, from developments of almost daily occurrence, to become second to none in interest in this respect. The appliances of our civilization are bringing to notice, in Kansas, a race unknown to history or tradition, and whose very existence, from any monument or vestige appearing upon the surface, might have remained unsuspected and unmarked forever, but for those appliances.

The district of country explored is in Marion county, Kansas, and extends from Florence, on the Atchison, Topeka & Santa Fe R. R., to four miles north of Marion Centre, situated on a branch of that road. This entire area, extending along the Cottonwood Valley and border of the low hills bounding it on either side, to use the language of my young friend Melvin Billings, to whose indefatigable researches we are indebted for most of the facts I lay before you, "is covered and underlaid with human remains." My own observations sustain the justice of this statement.

In the environment of the confluence of Clear Creek, Mud Creek, and the Cottonwood, in the vicinity of Marion Centre, there is evidence of three distinct races, which preceded our present civilization. Evidence of the most recent is to be found in the burial places of our modern Indians; next a hundred or more of low mounds or borrows containing human remains, such as fragments of pottery, stone and bone implements, ashes, charcoal, hurnt clay, stone pipes, and human bones, testify to a greater antiquity; and evidence of the remaining, and most ancient race, is to be found in human remains without anything whatever upon the surface to indicate their presence.

These last are encountered in excavations for cellars, in well-digging, and in the cuts of the M. & M. P. R. R., a branch of the A., T. & S. F. R. R., before alluded to. The latter class of remains, especially on the low hills fringing the valley, are all, so far as I had an opportunity to observe them, found in a Lacustrine deposit, under a deep, black vegetable mold, and rest on the Glacial drift. This was the case at the cellars of Mr. Baylis and Mr. Case, at Marion Centre,

*Read before the Kansas City Academy of Science, May 25, 1880.

where human remains were found. At each place I observed the Drift cropping out on the hill-slope at a short distance from the cellars. I also observed drift pebbles, which had been thrown out from the bottom of each cellar. In digging a trench from Mr. Baylis' cellar a stone mortar was found at about the same depth of the cellar, and was covered over in filling the ditch and left remaining where found. But it must not be inferred that these two cellars are the only places where these mysterious remains are encountered.

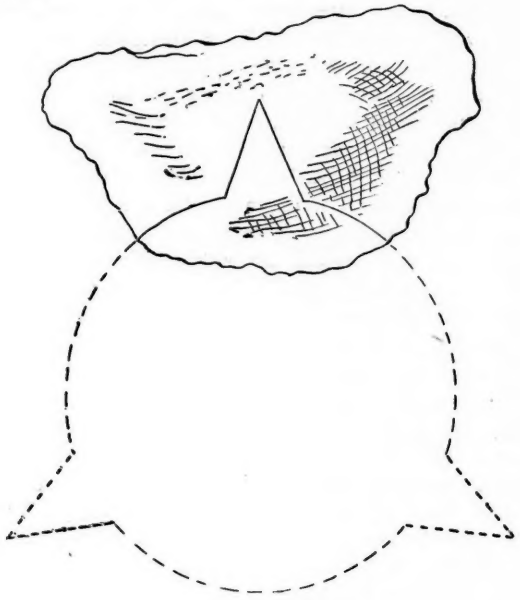
Mr. Billings, in a former letter to me, says: "In the excavation of nearly every cellar and well in town some relic of aboriginal inhabitancy has been found." His residence is with his father, a short distance out of town, and, in the same letter, he says: "In digging a cistern at my home, one of these peculiar graves was struck, from which charcoal, burnt bones, flint chips, etc., were taken. In excavating the basement of our barn, 38 by 40 feet, seven of these graves were discovered." The M. & M. P. R. R. crosses Mud Creek some two or three hundred yards south of Marion Centre, and, in the same letter, Mr. Billings continues: "In grading the approaches to the bridges a large amount of pre-historic debris was discovered, among which are broken bone implements, stone arrow and spear points, stone axes, grooved mallets, rub stones, broken pottery, etc."

But the best observed graves of this kind, if graves they are, were found at the brick-yard of Mr. W. S. Moulton, one and a half miles north of Marion Centre. These were well examined by Mr. Billings and Mr. Moulton, and possess some very remarkable features independent of their evident great antiquity. The clay used by Mr. Moulton is a Lacustrine deposit containing lime connections, and is very similar to the Loess or brick clay in this city. It is three to four feet in thickness, only, covered by two feet of black vegetable mold, and rests on the Glacial drift. Mr. Moulton has removed the clay, in his brick-making, over a space of less than fifty feet, but in this small area he has found eleven of these buried repositories of the dead. They are cone-shaped, covered over with two feet or more of undisturbed vegetable mold, and all rest on the Drift. From a careful measurement of some of these, by Mr. Billings and Mr. Moulton, they were found to be fifty-four inches in diameter at the base, eighteen inches at the top, and thirty-six inches high; i. e. there is found in the clay, of these dimensions, a black cone-shaped mass of mixed ashes, charcoal, fragments of shells, intermingled, perhaps, with clay and containing human remains.

What is very remarkable, the base of the cone, at equal distances, sends out three triangular projections of about twelve inches in extent; and, still more remarkable, is the correspondence with this configuration of an ornamentation, or carved figure, on a fragment of the pottery found. The ornamentation seems to have been sculptured after the vessel was partially dried, and before burning. There is but a part of the figure or emblem on the fragment obtained, but there is enough of it remaining to associate it with the peculiar shape of the receptacles found imbedded in the clay, without any great stretch of the imagination. The part of the figure remaining forms an arc of a circle, with one of the triangular

shaped projections based in it. All this will be better understood by the engraved representations in Figs. 1, 2 and 3.

The dark lines in Fig. 1 represent the fragment of pottery and segment of the figure remaining on it, and the dotted lines the lost segment, or the figure restored as supposed to have been sculptured on the vessel. Fig. 2 represents the base of the repositories as outlined in the clay. Fig. 3 represents a side view of the repositories.



Flg 1—Full Size.

What is the peculiar shape of these repositories and figures emblematic of? Possibly of the sun. The people who conceived and fashioned them must have had some knowledge of geometrical lines and a considerable degree of intelligence.

All who have examined the repositories, without exception, with whom I have conversed, agree that the vegetable mold must have formed over them since they were made. They rest on Glacial drift, and must have been formed since that deposit. But the questions remain to be answered—were they excavated in the Lacustrine clay, or were they erected before its deposit and covered in by it? It seems difficult for a primitive people to plan and make an excavation of such shape; and these repositories may have been formed of some kind of cement upon the surface, before the Lacustrine time and covered by its deposits, and since undergone disintegration.

Marion Centre lies on the southeastern slope of the summit dividing the

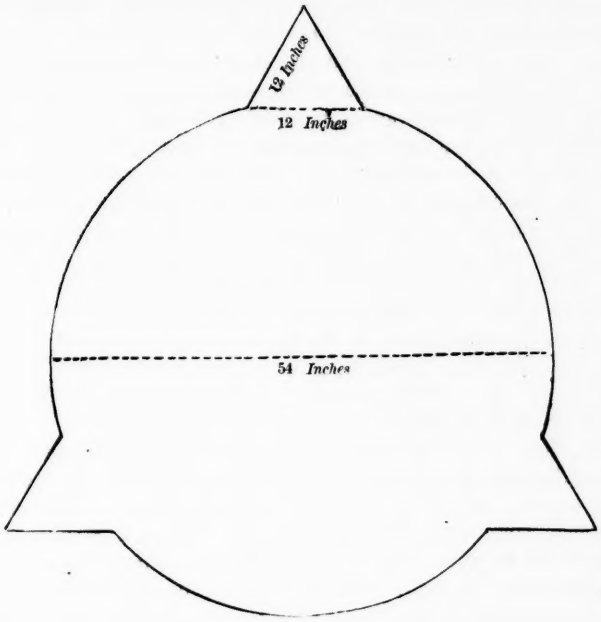


Fig. 2.

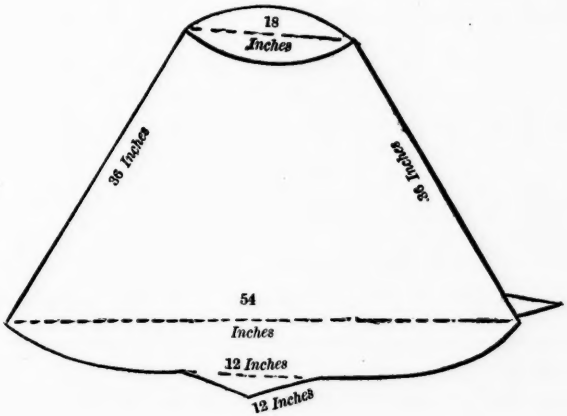


Fig. 3.

water-shed of the Arkansas river on the south, and the Smoky Hill river on the north, and is more elevated than the valleys of those streams on either side.

What connection, if any, these remains have with those I formerly described,

found at a greater depth in those deeper valleys, remains to be determined by farther developments. If, however, they rest upon the Drift, as those here described do, and it is most likely that such is the case, the only difference would seem to be in the thickness of the covering over them, which would naturally follow from the differences in elevation when the deposit was accumulating, *i. e.*, if the lake water was four feet at the Moulton brick-yard and thirty feet at Ellsworth, supposing remains on the surface at each place when the deposit began, those at Ellsworth might be covered to a depth of thirty feet, while those at the Moulton brick-yard would only be covered four feet. Such remains might belong to the same race, if we suppose an occupancy prior to the submergence of the country.

It would require months of patient investigation to bring into order the facts connected with this very interesting and mysterious race, and I regret that I have not the means to prosecute the work; but hope some one more fortunate will do so.

The Glacial drift underlying the clay at the Moulton brick-yard is well marked and not to be mistaken.

The day devoted to these investigations proved to be tempestuous and rainy, but, by the kindness of my young friend's father, who placed a splendid team and wagon at our disposal, we braved the "tempest and the storm" and accomplished a good day's work. We visited several cellars, the Moulton brick-yard, some cuts on the M. & M. P. R. R., and took in mounds by the score.

The Atchison, Topeka & Santa Fe Railroad deserves great credit for the interest it has manifested in developing the beautiful country lying along its line, and the facilities it has generously afforded scientific explorations in Kansas, and merits the thanks of this Academy.

GEOLOGY AND MINERALOGY.

GEOLOGY AND EVOLUTION.*

BY THE LATE PROF. B. F. MUDGE.

CHAPTER I.—LAWS OF EVOLUTION. SILURIAN FOSSILS.

The doctrine of evolution is by means new. It is found in the oldest writings of antiquity, and appears to have secured a few believers in all ages. But it is only within the last hundred years that it has assumed a scientific garb. La-

* NOTE.—We present in this number of the REVIEW the introductory chapter of a series of articles written by the late Prof. Mudge on Geology and Evolution. Chapters IV and V of this series have already appeared in the REVIEW under the head of Botany and Evolution While it is to be expected that many of the conclusions and deductions from his train of argument will be denied and objected to by the opponents of Evolution, these are nevertheless a valuable contribution to the literature of the subject, by one of the best observers of our day, and one who has had many opportunities of investigating this theory in connection with his favorite sciences—Geology and Paleontology. The articles are just as they came from his pen, with the exception of the necessary correction of a few obvious errors.—L.

marck, and, a little later, the author of Vestiges of the Natural History of Creation, and quite recently, Darwin and his followers, have given it a prominent position in the scientific world.

The strongest arguments and facts presented in support of their theory, have been based on living organisms. Our position on this question is, that the present period, or even the whole of the historic time, is far too short to settle the question of the evolution of the higher orders or genera, from the lower; and it is only in the long, long ages of geology that such changes can be studied with accurate results. To us it appears that geology must be the final arbiter in this great problem. We now propose to see how far this science can furnish evidence upon the subject of evolution.

In advance we state three laws which will guide us in the investigation, viz:

FIRST. *If evolution be true, it must be the ruling law, more or less apparent through all animated nature; or at least be seen in a majority of all species and genera of organic beings.*

SECOND. *That it should be most clearly observable in those species, whose fossil remains are most numerous and most widely disseminated.*

THIRD. *That the development from the lower to the higher type, should be symmetrical and harmonious.*

By the third law we mean that when animals are claimed to be derived from a lower form, advancement should be seen in all parts of the body, both internal and external, in the same degree. Prof. E D. Cope, an advocate of evolution, has expressed the idea in the following terms: "The natural deduction is, that if a portion of an animal exhibits a form intermediate between two known forms or types, the remainder of the animal structure possesses the same kind of intermediacy."* He has endeavored to show a modification of this rule in some cases, but the main principle stands unchanged.

We think these three laws may be fairly and candidly deduced from what we already know of the operations of nature; and are not inconsistent with the principles laid down in the writings of Prof. Darwin and his associates.

Now if the student in fossil remains finds forty-nine out of fifty of the most abundantly preserved species, showing no marked change, over large areas and during long geological periods, even if the remainder should present some apparent development, in a slow degree, he has a right to conclude, that evolution is not a law of nature, and that no high type has arisen or can arise from the lowest.

There are about 50,000 known species of fossil plants and animals. Some of these are represented by very few specimens, others by hundreds or thousands, and not a few by millions. We consider ourselves justified in saying, that at least one-tenth part (5,000) are sufficiently numerous and well preserved to show the changes of evolution, if it exists.

It is apparent that in all animated nature, there is a great diversity in the appearance of different individuals of the same species. But we take the position,

* Cretaceous Vertebrata, p. 8.

which we believe we can prove, in the following pages, that this constant, ever present variation is always within a narrow limit. Thus, no two oysters, horses or men are just alike, but their varied appearance is within a narrow circle. No two members of the human family are just alike, yet we easily detect the German, French or Irish element, yea, even family traits, in the men we daily meet. This constant variation, is accompanied by an equally constant adherence to the normal type. No two sharks are just alike, and different genera and species have a regular variance from each other, but the microscopic cell-form of the shark's tooth, as given by Owen in his Odontography, is the same in the earliest tooth of the Devonian and in all later geological strata, as well as in the living sharks of our ocean. No two pine trees have the same shape, yet the cell-form of the wood, so small as to require a strong magnifier to see it, is always of the same elongated shape and with the same marking, whether from the Devonian age or from the living Auricarian pine. This unyielding persistence will be brought in view in the examination of the varied phases of organic life.

In looking at the facts of geology the great rule is apparent that in a very general way the oldest fossiliferous strata contain only low types of animal and vegetable life, while the later formations contain higher forms, in proportion as they become more modern. This general rule, however fails in detail, as we shall endeavor to show. The oldest Silurian does not begin with the lowest forms of the five great sub-kingdoms of animals, as it should according to the laws of evolution, but has numerous representations of four sub-kingdoms, viz: Protozoans, Radiates, Mollusks and Articulates. The Protozoans, which are the lowest, and consequently according to the theory of evolution, should be the earliest and most abundant, are not found at the first; and when found are the least abundant of the Primoidal found. The representatives of the Radiates, Mollusks and Articulates, are not the lowest of their kinds. This fact was thus strongly and clearly stated at a recent meeting of the British Association by Dr. Thomas Wright, President of Section C. "Instead of a gradation upward in certain groups and classes of fossil animals, we find on the contrary, that their first representatives are not the lowest, but often highly organized types of the class to which they belong. This is well illustrated in the Corals, Crinoids, Asteridæ, Mollusca and Crustaceæ of the Silurian Age, and which make up the beginnings of life in the Palæozoic period. The fishes of the Old Red Sandstone, we have already seen occupy a respectable position among the Pisces; and the Reptiles of the Trias are not the lowest form of their class, but highly organized Dinosauria."

Dana* also says, "If we may trust the records, Echinoderms, or the highest type of Radiates, were represented by species (Cystids and Crinids) long before the inferior type of Polyps existed.†"

The examination of the Silurian fossils in detail are instructive on this point. Barande in his valuable publications on the Silurian, has given us the results of his studies on this system from twelve district regions. Dividing it into three

* Nature, Aug. 2s, 1875, p. 357. † Mammal, p. 598.

periods he tabulates the fossils of the first division. From this he reports from the four sub-kingdoms above named, 366 species. Of these, 264 or seventy-two per cent belong to Crustacea, the highest of these sub-kingdoms. So while on theoretic grounds only the lowest sub-kingdom should have been represented, the highest outnumbers all the others by nearly three-fold. In abundance of individual specimens, the trilobites, the most common crustaceans, outnumber by a hundred-fold all other fossils in the first division of the Bohemian Primordial. Barande further states that the families and orders are entirely without transitional forms.

If we examine all the fossils of the Silurian Age, we shall find a somewhat similar result. Barande gives 10,074 as the number of Silurian Species known and described up to 1872. Of these only 153, or less than two per cent, are Protozoans—1,306 or thirteen per cent are Radiates, while 2,112 or twenty-one per cent are Crustaceans. It will be seen that the highest, though not as numerous as the next lowest sub-kingdom, contains more than both of the lowest two. This proportion in favor of the Crustaceans is greater than exists in the living species.

If we examine the number in the classes of the Mollusks we shall find results, though not as strong, still in favor of the highest. Cephalopods, the most complete in organization, are the most numerous. It will also be seen that there is no order or harmony in the number of each class. Placing them in the order of their rank we have in number of species and percentage;

Cephalopods	1,622	.27
Pteropods and Heteropods	390	.06
Gasteropods	1,316	.22
Acephala	1,086	.18
Brachiopods	1,567	.26

The EXTREMES are most strongly represented.

Much has been said about the possibility, that all animal life has been derived from the Ascidian. If so, it should appear among the earliest fossils. But it has never been thus found. It has been asserted that because it has no solid parts it could not have been preserved if it had existed. It has a tough leathery exterior, far more firm than many an animal found fossilized. We have the impressions of the soft bodies of spiders preserved in the Carboniferous rocks; and 185 species of worms have been described from the Silurian. Our marine plants found in all geological ages, are of softer texture, yet we find their outlines well preserved. Besides, the living Ascidians are frequently covered by the calcareous material of Bryozoans, which would aid in the preservation of the leathery sack. No intermediate form between the Ascidians and the vertebrates exist among fossils. The size of many species, eight inches and over, would enable them to be easily seen, if only the outline had been preserved.

To any one who has studied the character and relations of the fossils of the various geological formations, it is very clearly discernible, that while the first forms are not like the animal life of the present day, they are very far from being

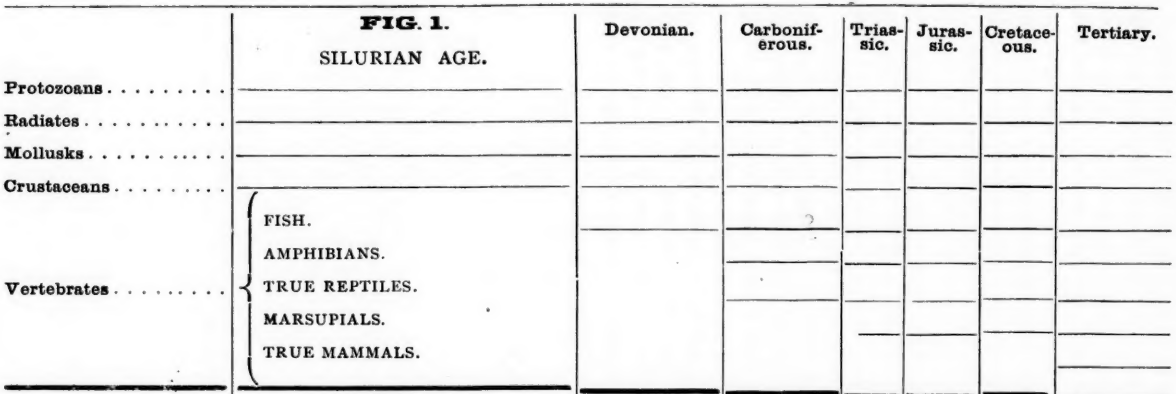


FIG. 1.
SILURIAN AGE.
Devonian.
Carboniferous.
Triassic.
Jurassic.
Cretaceous.
Tertiary.
Protozoans
Radiates
Mollusks
Crustaceans
Vertebrates
FISH.
AMPHIBIANS.
TRUE REPTILES.
MARSUPIALS.
TRUE MAMMALS.

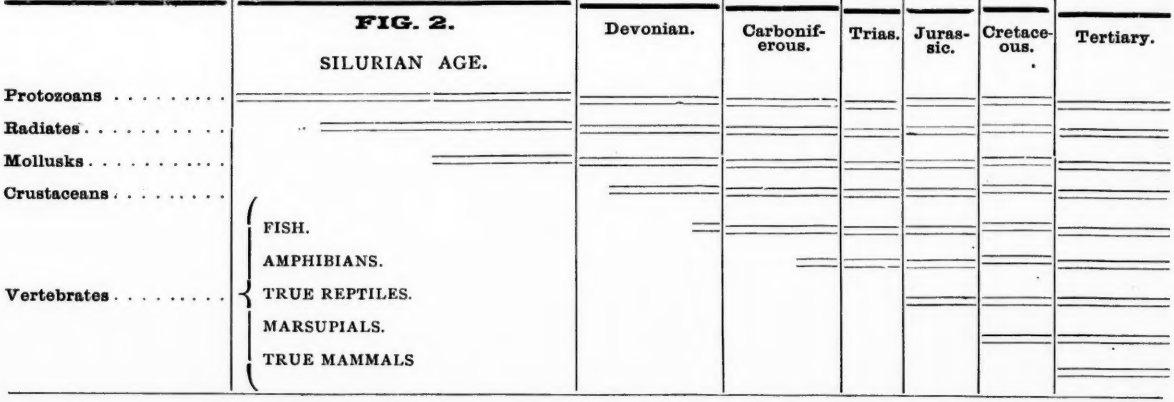


FIG. 2.
SILURIAN AGE.
Devonian.
Carboniferous.
Trias.
Jurassic.
Cretaceous.
Tertiary.
Protozoans
Radiates
Mollusks
Crustaceans
Vertebrates
FISH.
AMPHIBIANS.
TRUE REPTILES.
MARSUPIALS.
TRUE MAMMALS

in harmony with any system of development. To show this the more plainly to the eye, we have given two Figs.—1 and 2, exhibiting the times of the appearance geologically of the various forms, and also the relative periods at which they should have appeared according to the system of evolution.

Fig. 1 is condensed from Dana.* It will be seen from this that four of the five sub-kingdoms of animal life—all but the vertebrates—came in together at the beginning of the Silurian, when if there was in nature a systematic plan of development, the Protozoans should have appeared first, and the others followed in the order of their organic rank. The latter idea we have endeavored to show in Fig. 2. We have divided the time nearly equally between the fine sub-kingdoms. This may be giving the lower forms more importance than they deserve for they are not equally dissimilar in the degree of their organization. But it is usually stated by evolutionists, that the lower the type the more slowly is the change of advancement. This we think justifies the statement that the time required for the Protozoan to become a Radiate would be as long as for the highest Crustacean to become a Vertebrate. Our tables in Fig. 2 may not be entirely accurate, but they are certainly so approximately. It is enough to show how entirely antagonistic are the facts of the earth's early history to the theory of development. The great difference of life rank, between the different sub-kingdoms, is admitted by all Zoölogists.

Similar tables (see Figs. 11 and 12) in relation to the geological and theoretic appearance of vegetration, gives nearly the same results.

NOTE —We have commenced, in our geological history and observations, with the fossils of the Lower Silurian. The fossils below that age are so few and obscure that they throw little, if any, light on the subject under discussion. Whether Eozon Canadense is organic, is an unsettled question in the scientific world.

Dana in referring to the oldest Silurian fossils has stated that they were not less than fifty millions of years old. We shall use that standard of time, in the following pages, though most European geologists assume a much longer period. [See appendix for the Geological Ages and Periods.]

PRECIOUS METAL MINING IN THE UNITED STATES.

BY N. S. SHALER.

* * * * * * * * * * * *

The fields of the precious metals in the United States may be generally divided into two principal areas, that of the Appalachian and that of the Cordilleran ranges. Besides these there are the smaller regions, which may be termed in a similar fashion, from their neighboring mountains, the Laurentian, including the region about Lake Superior, and the Ozark region about the mountains of that name in Arkansas and Missouri. There are lead ores in several of the States of the Mississippi Valley, at great distances from these mountain ranges, that contain a small proportion of silver, but in few cases does this silver exceed about the four or five thousandth part of the ore; nor is there any chance that they will ever produce this metal in quantities of the least commercial importance.

* Manual, pps. 386 and 589.

XUM

The whole of the rich agricultural region of the Mississippi; the whole of the Western plains, through all their extent to the one hundred and second meridian west from Greenwich, and on their northern section to the one hundred and tenth meridian; the whole of the low-lying plains of the Southern States, in all containing a little over one half the total area of the United States, but at least nine tenths of its arable land, is sure never to prove productive of any the metals now known to the arts, save iron, lead, and aluminium; and of these lead will never be again economically produced there, until the mining industry of the Cordilleran region begins to wane.

This rejection of the larger part of national area from the list of regions where gold and silver may be found in profitable quantities is based upon actual experience of the generations grown up within the area, as well as the general fact that the experience of other countries shows us that such rocks as underlie this region are always marked by the absence of gold and silver in profitable quantities.

Of late years there has been a great advance toward a learc understanding of the natural processes by which metallic deposits are brought into the shape in which the miner finds them. All the old notions about the outburst of mineral veins, by fiery ejection from the deep interior of the earth, have been cast aside. Geologists now pretty generally recognize the fact that all our metals are deposited in our stratified rocks as they are laid down on the sea-floor, having been separated from the sea-water, as a great part of all the rocks are, by the action of sea-weeds and marine animals. * * * * * *

Whoever looks over the whole field of American precious metal mining will be convinced that this industry is certain to make a very rapid growth in what is left of this century. He will also come to the conclusion that the production of silver is destined to increase very rapidly for a score or so of years to come, provided the demand for this much slandered metal does not fall too far short of the supply. Beyond a brief term this yield of silver will surely diminish, especially if there is any considerable lowering in its price. The observant eye can also see that the production of gold is likely to extend to many new fields, and that the yield of this metal is in the future likely to be rather more steady than that of its bulkier sharer in the greed of men. North America and the twin continent on the south are doubtless to be the great producers of precious metals in the future; their store of silver must be of greater value at the present price of this metal than their store of gold. If the world continues to use silver in the coming century as it has in the past thirty centuries, there is a fair prospect that our continent will win some thousands of millions from its silver-bearing lodes. Even if we make what seems to me the mistake of using gold alone as a basis of exchange, the production of this metal will no doubt give us a larger mining industry than any other country can expect to gain.—*June Atlantic.*

ENGINEERING.

ASPHALT PAVEMENTS.

GEN. Q. A. GILLMORE, U. S. A.

Within the last twenty-five years bitumen, in some of its many forms, has been employed to a considerable extent, as the binding material or matrix for road and street coverings laid in continuous sheets without joints. They are all comprised under the general head of asphalt pavements. The city of Paris took the lead in this innovation upon the former methods of paving with stone, the reasons assigned for the change being, (1) the want of connection and homogeneity, in the elements of which the stone paving is composed, (2) the incessant noise produced by them, (3) the imperfect surface drainage which they secure, by reason of which the foul waters are not carried off but filter into the joints, and (4) the ease with which they can be displaced, and used for the construction of barricades, breastworks and rifle pits in time of civil war.

The forms of bitumen most extensively employed for pavements are *mineral tar; asphalt rock*, which is an amorphous carbonate of lime impregnated with mineral tar, and known in commerce as *bituminous limestone; asphaltuu;* heavy *petroleum oils* like those from West Virginia, or others not volatile under 212 Fah., or the residuum of refined petroleum containing no water, and so refined as not to be volatile at 212 Fah.

The principal sources of the natural mineral tar of commerce are in France, at Bastenne (Landes) and at Pyrimont Seyssel (Ain), and in Switzerland at Val de Travers, in the canton of Neuchatel. At Bastenne as well as at Gaujac, in the south of France, it flows frome sevral springs mixed withwater.

Asphaltum is a variety of bitumen generally found in a solid state. At rodinary temperature it is brittle, and too hard to be impressed with the finger nail. It is black or brownish in color, opaque, slightly translucent at the edge of a new fracture, of smooth fracture, and has little odor unless rubbed or heated. It melts easily, burns with very little if any residue, and is very inflammable.

It is found floating on the Dead Sea, and in many places in Europe. Many localities in Mexico supply it, and it abounds in the islands of Barbadoes, Trinidad and Cuba, and in Ritchie county, West Virginia, and in New Brunswick, Dominion of Canada.

A capital distinction must be made between pavements of asphalt hereafter described, made either with natural asphalt rock, or with the refined asphaltum as a cement, combined with suitable calcareous powder, and all or nearly all of those attempted imitations of it, produced by mixing crude mineral tar, or manufactured tar, with one or more pulverized minerals or earths. And more especially must we exclude from the category of asphalt pavements, all those

patent street coverings composed of wood-tar, coal-tar, pitch, rosin, etc., mixed with either sand, gravel, ashes, scoria, sulphur, lime, etc., or with two or more or all of them. Some of them will produce a tolerably fair sidewalk, but they are totally unfit for the surface of a carriage way. Some of the best of them will answer for carriage way foundations.

The rock should be of the fine grained variety, of tolerably close texture, and composed of pure carbonate of lime so uniformly and homogeneously impregnated with the bitumen, that a cut made with a sharp knife will show neither pure white nor jet black spots, but be of a brownish liver color, mottled with gray.

When asphalt rock of this character is heated to a temperature of 200° to 212° Fah., the bitumen becomes soft, the grains of limestone separate from each other, and the mass crumbles into a partially coherent powder. If this powder while still hot, be powerfully compressed by ramming, tamping, or rolling, the molecules will again unite, and the mass when cold will assume all the essential qualities of the original rock, but in a superior degree, as regards toughness, hardness, and incompressibility. This is the whole theory of asphalt road coverings, as applied to the street pavements in Paris and elsewhere.

Mention has been made of the superior toughness, hardness and incompressibility, conferred on bituminous limestone by compressing it while hot. This property characterizes any genuine asphalt mixture suitable for paving purposes, and advantage has been taken of it, in first forming the material into rectangular blocks under a heavy pressure, and then laying them in courses across the street, substantially after the manner followed in constructing the best stone block pavement. It is, perhaps, needless to say that a pavement of this kind, composed of good materials, properly prepared, and laid upon a firm and unyielding foundation, should be a good one. Specimens of it have been on trial for some years in San Francisco, Cal. The blocks are made with Trinidad asphaltum, softened with 7 to 9 per cent. of the heavy oils or still bottoms, used in preparing the asphaltic cement. This preparation is mixed with hot powdered limestone, or powdered furnace slag, and then compressed with a force of about fifty tons into blocks measuring 4 inches by 5 inches by 12 inches. The pressure, which is applied to the narrowest face of the block, exceeds one ton to the square inch. The limestone or slag is not required to be of the fineness of impalpable powder, but is composed of grains of all sizes from dust up to the size of a small pea.

The blocks are laid close together on their longest edges, in courses across the street, breaking joints lengthwise of the street, the joints being filled with suitable asphaltic cement so as to render the pavement water tight. The foundation should be firm and stable, such as the best of those described on pages 143 to 149. This pavement while new would be nearly as smooth as that of the continuous sheet of asphalt heretofore described, but the wear of heavy traffic would, in a short time, crumble off the edges of the blocks and open the joints

at the surface sufficiently to give the horses a foothold, without impairing the imperviousness of the covering. It is suggested that it would be better to form the blocks with slightly truncated or rounded edges, so as to give the requisite foothold when the pavement is laid, rather than to secure the same end by the irregular and ragged abrasion caused by use. As they are homogeneous in toughness and hardness, the blocks can be taken up, and their surfaces become uneven from unequal wear, and relaid in mortar, bottom side up, with all smoothness of a new pavement. It may be added that the process of refining and careful manipulation, is equally necessary whether the material be applied as a monolithic sheet, or as blocks, and any mixture that is suitable for the former is also suitable for the latter; also, that a form of sand is not a proper foundation in either case.—*Roads, Streets and Pavements.*

THE HUDSON RIVER TUNNEL.

The work of tunneling the Hudson River is pushing steadily on, and it is expected that in three years from now trains arriving in Jersey City will run directly through to New York, and land their passengers in Broadway, somewhere near the Metropolitan hotel, in six minutes' time. The company says that more than 100 trains of cars could be passed through in twenty-four hours on the double track.

Freight trains will use the tunnel exclusively at night, and market trains in the early morning. All will be drawn by engines made especially for the purpose. These will consume their own steam and smoke. A powerful engine will be always at work forcing air into the tunnel. The entire length of the tunnel will be 12,000 feet; that is, about one mile under water and three-quarters of a mile on each side. Thus far only the New Jersey end has been bored, but the work on this side will soon be begun and excavations will proceed from both banks until they meet. As many men will be kept constantly engaged day and night, as can be successfully employed at once, in making the hole and building the lining wall. The gangs will be changed every eight hours, thus doing three days labor every twenty-four hours. All the work will be done by electric light. The tunnel will be lined throughout with iron plates, and these in turn will be faced all over with the best hardened brick and hydraulic cement, three feet thick. The brick will be made from the refuse taken from the tunnel. This, it is said, will effect a saving of $2.25 on every thousand used. As there will be 2,013 brick in each running foot of wall, it will be seen that the saving is considerable. The interior will be painted white and lighted with gas. The entrance in Jersey City will be from Jersey avenue in Fifteenth street. The tunnel will be a single one, twenty-six feet wide and twenty-four feet high in the clear down to within a few feet of the river on both sides, and a double one all of the way under the water where the two tunnels will run side by side, each eighteen feet high and sixteen feet wide in the clear. It is to extend from Jersey avenue to

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Hudson street and the river, about 3,400 feet; thence under the river, curving five degrees northward to the New York bulkhead line at or near the foot of Morton street, about 5,400 feet, then curving slightly southward in New York, about 3,000 feet, to a point to be selected by the city authorities. The extension grade of the tunnel is two in 100 feet descending from Jersey City, then ascending on the New York side three in 100 feet for 1,500. From that point the ascent will be on a grade of two in 100 feet to the New York end. The greatest depth of water in the river is about sixty feet. Most of the bottom of the river bed is composed of tenacious silt, underlaid by hard sand. Near the New York shore a small extent of rock is encountered and some gravel.—*St. Louis Journal of Commerce.*

CHEMISTRY.

BOG BUTTER, FROM COUNTY GALWAY, IRELAND.

Mr. John Plant, F. G. S., exhibited at a meeting of the Manchester, England, Philosophical society, January 19, 1880, a piece of mineral resin, familiarly known in the west of Ireland as Bog Butter, (Butyrellite). The lump weighed exactly 14 ozs. It came from a good depth in a bog in County Galway. A few years ago, when in that part of Ireland, he had been unsuccessful in meeting with a sample of this curious substance, although he was informed that it was not unfrequently met with by the turf cutters during each summer. He heard of its origin and some of the uses to which it was said to be put by the poor people, if they got any of it, from a farmer at Killkee, but he could hardly credit the statement that in hard times it was melted down and actually used as a dripping to the potatoes; he rather concluded that the greasing was limited to the axles of the potato cart. The Irish have a widespread belief that bog butter was hidden by the fairies in the bogs long ages ago; and it is affirmed that the butter is sometimes found in small wooden kegs in bogs along the coast. These kegs they say have been hastily buried by smugglers running a cargo of contraband, though when bog butter was declared an illegal article of trade in Ireland they are unable to say. Unfortunately, Mr. Plant was not shown a keg, or even a staver of a keg, but he was informed that specimens of veritable kegs of bog butter are to be seen in the Museum of the Royal Irish Academy and in the museums at Edinburgh. The fairy origin of the bog butter he thought might be ascribed to the active imagination of the Celtic brain, many of the inexplicable things in nature being readily put down to the good or evil doings of the indigenous fairies of Erin.

By the aid of scientific analysis the substance called bog butter can be shown to be a perfectly natural production arising from the decomposition of the vegetable matters forming the peat or bog, and to belong to the numerous family of

mineral resins, or hydrocarbon compounds, of which Dana describes the composition of seventy species.

Many of these are very well known under the names of marsh gas, petroleum, ozocerite, asphaltum, naphtha, paraffin, bitumen, amber, torbanite, coal, and its varieties.

Some of these singular minerals are obtained only from bog and peat beds

Some time ago Mr. Plant showed to the Section a quantity of one of these resinous minerals, which occurred under the bark of pine logs found in a moss at Handforth by Mr. P. G. Cunliffe. It proved to be known in Germany as Fichtelite, but had not before been known to occur in Great Britain. Afterward it was found in pine logs in the peat on Lindow Common. A waxy, greasy, or butter-like character is distinctive of these bog products. The one now exhibited was described first by Brazier in 1825, and was analyzed by Willamson in 1845, its composition being given as

Carbon.	73.78
Hydrogen	12.50
Oxygen..	13.72

When fresh from the bog it is soft and like butter, but hardens in drying. The mass is dirty and bogstained on the outside, but inside pure white and free from impurities. It melts at 50° C., and becomes a yellow greasy resin; dissolves in alcohol or in ether, and then crystallizes in beautiful needles. When heated it gives off a peculiar odor like acroline. By saponification with potash it yields an acid which Brazier proves to have a composition similar to palmetic acid

There is a mineral waxy resin called Guyaquillite, which is found in extensive deposits in the marshy plains near Guyaquil, in South America, which has a similar composition to bog butter.

Johnson gives it as

Carbon..	76.67
Hydrogen.	8.17
Oxygen	15.16

It has been proved that the slow decomposition or change in the vegetable peat or moss will produce elements of which these hydrocarbons are made.—*Chemical News.*

CARE OF STOVES.

The season is at hand for removing stoves from the rooms they have warmed during the winter. A few words of caution may not be amiss. Iron is more sensitive to the hygrometric changes in the atmosphere than any other commonly used metal; at least it is more susceptible of permanent injury from dampness. The planished surface sheet iron, known as the Russia iron, resists these insidious approaches of the foe of metals much better than our common iron; but there is

no mechanical means known of so thoroughly compacting the outer fibers of sheet iron as to prevent the action of moisture. Unused and uncared-for Russia sheet iron, unless kept in a place of equable dry temperature soon shows pin spots and blotches, like mold, and these are the beginnings of disintegration. Those stoves which use wood or charcoal as a fuel, or for kindling, are particularly liable to decay. The inside of the stove and the pipe are attacked by the pyroligneous acid contained in the soot and soon show the effects after being taken down. So long as a fire is kept up the heat counteracts, in some measure, the attacks of the acid; but when put away for the summer the soot has opportunity to act, especially if it is aided by the damp atmosphere of a cellar, or the variable draughts of an outhouse. The garret, or a room above the living rooms, is the best place for unused stoves and funnel. Perhaps the time will come when the superior advantages of sheet brass to sheet iron will be conceded, and our sheet metal stoves and pipe last a generation and grow handsomer as they grow older. Brass—any of the alloys of copper—is preserved from decay by its atmospheric oxide. The rust of brass preserves the metal and ornaments the surface. The oxide of iron disintegrates and "kills" the metal and disfigures the surface. Cast iron is worse in its objectionable features. A cast iron stove once rusted is a deformity and an eyesore. No amount of "Rising Sun" or "Carburet of Iron" can restore its pristine beauty or conceal the ravages of rust. The only way to preserve for the summer our red hot winter friends is to keep them in an equable atmosphere as to humidity; don't let them dry up through negligence nor weep out by carelessness.—*Boston Journal of Commerce.*

EDUCATION.

SOME THOUGHTS ON THE PRINCIPLES OF INSTRUCTION.

BY PROF. E. C. CROSBY, KANSAS CITY, MO.

Thoughtful comparison of our best common schools with schools of an earlier time, suggests the conclusion that, although we are struggling in the dawn of a better age, we have hardly escaped from the traditional empiricism which forms the literature of the past. Probably, one of the greatest obstacles to progress is the paradoxical aversion of teachers themselves to scrutinizing their own methods with the same interest and persistence manifested by them in pursuing light literature, society, fashions and gain.

A child of six years must attain some proficiency in many subjects, if he would leave the school room, at the age of seventeen, respectably intelligent. Hence, arises the question, "What subjects should be pursued during these few years?" But this question is inappropriate to the case at hand. Let us see.

It is autumn, and the fruitful farm groans under its splendid burden; but last night a destructive fire swept away every tool and instrument, save one, with which to gather the crops. Suppose the farm is sold to a foreigner who is unacquainted with our farm implements. There are the fruits to be gathered and shipped, the wheat to be stored, the corn to be husked, the field to be plowed, &c., and there is but one instrument with which to do the work. His first inquiry evidently is, "What kind of work will this instrument perform?" and not "Which crop shall I gather first with this instrument?" Now, mind is the sole instrument with which the educator deals, and, evidently, his first question must be, "What kind of work will this young mind perform?" and not the question, "Which branch of study must first be mastered?" The profounder educational questions, then, underlying all others, are: What are the principles of mental action? What are the elemental acts in the process called "knowing"? These questions carry with them not the tacit but the living assumption that mind, in its several departments of intellect, sensibilities and will, is an indication, an expression of law; and it matters not to the present view whether that law be surmised or wholly unknown. This point settled, then, let us proceed to consider the questions: How do we acquire? What mystery lies concealed in the dawning of intelligence? How are mental faculties aroused to discharge their several functions, and in what order of succession? To answer these questions, we need to consult only our own experiences as simulated in the daily activities of a child. A simple illustration: A book falls to the floor; the floor trembles; the air quivers; the drums of the tympanum vibrate, and the internal ear transmits the vibrations to the nerve which carries them to the brain; terminating this series is consciousness of sound. An idea of sound is subsequent to these physical movements, which it could never precede. Without the former, the latter could have no existence. Likewise, the child can never have the thought of heat until its nervous organism has been affected by heat. In these acts of knowing, it would be difficult to determine whether the *sentiens* is more important than the *sensum*, but it is quite unimportant, since neither is dispensable. An object must be perceived before it can be conceived. It must become to us an object of sense before it can become an object of thought. It must first be presented before it can be represented. Ideas of roughness, area, elasticity, form, attraction, law, are based upon, are awakened by or arise from perceptions, and never precede them. And, generally, Frœbel's system is the only practical philosophy of education extant.

The class in Physics recites—no apparatus to illustrate the subject. The pupil answers: "A body is in stable equilibrium when it will return to its former position after it has been slightly disturbed." Well recited, but what does that mean? Illustrate. Here is a cone—explain your definition. Several attempts, failing to clear up the definition, succeed in showing a total want of comprehension of stable and unstable equilibrium. Success is reached only after many questions and failures. Here it is clearly shown that a definition is the

result of purposed investigation, and the result illustrates the truth that the mind is not a crib for storing away forms of finished knowledge, like the above definition, unless those forms have become the child's possession by tentative and experiential efforts. The mind, rather, is an instrument fitted for hewing out or modeling the knowledge products which it will possess. To begin with a definition is to begin at the wrong end of the educating process. It is much like getting a warranty deed to real estate before ascertaining its location, desirability and value. A definition, a generalization, a rule, a law, is a product of numerous observations and comparisons—a conclusion, the *finale* of a thousand experiences. The same truth is even more strikingly illustrated in the student's attempt to know the meaning of chromatic aberration, if presented to him in the form of a definition, clearly stated, with not more than fifteen words. Correct instruction requires the teacher to take his pupils to the glad fountain of experience, where the elements of knowledge and their symbols are severally known; where they may be individually studied in their relations to each other; where they may personally encounter obstacles and feel the glorious enjoyment of surmounting them; where, individually evolving the finished forms of knowledge for themselves, their exact contents will be known rather than solely the æsthetics of expression.

The necessity of perceiving completely and the trained ability of interpreting sensations are not outranked by any other department of educational science. A single illustration: A child sees a rock-salt prism for the first time. Vision alone is concerned. The child's conception of the prism consists of color, form, transparency and position. On the following day it handles the instrument. Now, the child's conception embraces, besides color, form and position, smoothness, temperature, resistance, solidity, weight, etc. Upon the third day, the senses of sight, touch and hearing are applied to the study of the prism. Now, its conception becomes far more complex. At the close of the fifth day, when the experimental process has been tolerably complete, let the question be asked, "Upon what day does the child possess the most perfect idea of the prism?" The answer is self-evident, likewise the reason. The greater the number of sensual experiences, both in number and in kind, brought to bear upon an object, the more accurate, positive and considerable is our knowledge of it. The mind has been reached by different avenues of sensation, the soul has been awakened to new life, true conceptions have been formed, and these have been correlated and harmonized by the individual activities of the mind to be improved, while they possess all the force, weight and power which it is possible for those conceptions to possess. Here is the practical question which more deeply concerns every parent: Should the schools possess the apparatus which will furnish the opportunity for these experiences? There can be but one answer.

I know it is a great mistake to think that when pupils arrive at their "teens" they have passed the period which makes experimental work a necessity. This common belief might have some probability in it, did they receive the proper training before arriving at that age. Prof. Cook, our American chemist, in a lec-

ture delivered before the summer school of chemistry, (1879,) declared that "students coming to the university can neither observe with any accuracy nor are they able to draw tolerably correct inferences from what they imperfectly observe;" that "the student should be brought into personal and original contact with facts, and, by practice, become able to draw correct conclusions from them; for these reasons, I find it necessary to take personal charge of the elementary classes, leaving the more advanced ones to the tutors." The same notes of warning and complaint have long been uttered by such educators as Porter, Bain, Agassiz, McCosh, Gore, Spencer and others who stand among the best teachers of our time, and still we continue in the grooves deep-worn far back in the Middle Ages—grooves so deep that he who attempts a statement of the principles which underlie acquisition is charged with being a "theorist," and his work is denounced as "not suited to the wants of the teacher," or as "shooting over our heads." Similar is the history of every move forward.

From whatever quarter we approach the fundamental principles of the educating process, there should be:

In Childhood.—Perceptive work, with few symbols.

In Youth.—Perceptive work, with many symbols.

In Manhood.—Symbols, not exclusively.

All theories of intellectual and moral discipline, devised by ingenious persons, disregarding the truth that law reigns among mental phenomena no less than among physical ones, must pass into forgetfulness, supplanted by one which rests upon the unalterable and eternal truth, so unmistakably illustrated in every human experience, and so concisely formulated in another century, that all our knowledge begins with experience.

It is well known that our educational system fails to cultivate and develop practical judgment, and this failure demands an explanation which will stand adverse criticism. I believe it a truth that is almost axiomatic, that every problem in mental economy and mental discipline must find its solution, ultimately, in the nature of mind itself. Education begins with sensual experiences, but it does not end with them. When these experiences have been made the child's possession by an exercise of the senses, then, and then only, should those experiences receive a name, which name—elasticity, for example—can be made no clearer by reference to a lexicon. Henceforth this word or symbol, whether thought, spoken or written, recalls the experience and takes its rightful place in the language of the child. Henceforth educational advancement is concerned with new experiences and their symbols, together with re-combinations, applications and rearrangements of the old ones, and this complex mental activity we designate as an enlargement of the boundary of mental vision. Again I assert that unless the child experiences, by the sense of sight or touch, the rebound of elasticity, as seen in rubber, glass or other substance, this quality of matter can never become a concept of his brain, and, consequently, it must remain as unknown to him as if it had no existence whatever. This real and individual

contact with other objects is clearly implied in Dr. Porter's analysis of the knowing process: "To know always involves two comprehensive acts, each of which corresponds to the other—the act of separating or revolving objects as wholes into their parts, and the act of uniting or combining these parts into their wholes."

Concepts are founded upon percepts, but the former are rarely permanent, complete and triumphant. Perfect conceptions require experiences rendered perfect by varied, like and similar conditions. Such symbolic knowledge, saving us the necessity of returning to sensual experiences, supplies every want and answers every purpose which symbols can provide, and with these the future progress of the pupil is mainly concerned. These truths must be granted; then, have we not a clear necessity for emphasizing the duty of making the child's perceptions not only complete but systematic? Every primary school should be provided with abundant apparatus, for instance, the units of length, weight and capacity. With these the pupil should be allowed to make the measurements for himself, whereby he practically determines the gills and gallons, the inches and yards, the ounces and tons. Thus do the gills, inches and ounces, as perceived facts, become the gills, inches and ounces of truly conceived facts. "True perceptions form the basis of intellect."‡ It can not be too strongly insisted that personal experience is the sole requirement for personal acquisition, and this knowledge, at first intuitively gained, becomes knowledge symbolically known. Knowing the full force of these psychological truths, an eminent educator* has well said that "in regard to science, our schools are not above those of the Middle Ages—then, the students repeated the obscure statements of Aristotle, while now students repeat the statements of their text-books, without obtaining any valid ground for the conviction they are required to express." It is not difficult to compare some traits in the character of two individuals, one of whom has made science the usual literary study, as witnessed in most of the schools throughout the country, the other of whom has been drilled in the practical methods which a correct study of natural phenomena demands. The first

Has learned how useful are devices,
And gives all honor to inventors;
"Promptness," he terms a business virtue,
Historic, importance, he says, it hath not,
Ampère, he calls the mightiest intellect,
Familiarly quotes from works of Bacon.
Adroitly speaks of heed and caution,
Cites stunning things that have existed—
Whose nebulous causes are historic,
(Is sure he read it in the text-book).
Dilates upon the accidental,
Declares the causes supernatural.

The second

Clears the way with new devices;
Execution nerves his sinews,
Judgment, prompt and vigorous action
Make many blessings fly about him.

‡ The Art of Scientific Discovery.—Gore.

* Prof. Hinrichs, University of Iowa.

Anticipating, calculating,
(Has met neither Ampère nor Bacon,)
Returns, persistent, to the details,
Explaining all conflicting portions,
Feels not too strong in his conclusions.
Here, "accidentals" claim attention,
(Has heard not of the early Fathers).
"Investigate it!" is the watchword—
Demands to know the hidden causes.

In the domain of morals, the same principles obtain. There are two kinds of government—one exerted by the teacher, parent or society, the other by the individual who is to be restrained. The most perfect restraint is seen in individual control, where the fountain of discipline is in an enlightened judgment coupled with nobility of purpose. The most abominable restraint is the purely external one, as seen in the school-room only when the teacher is present, or in a domestic circle in which the proprieties of deportment are compulsory. Commonly, discipline at home, in the school and in society exists by a union of these two kinds of restraints. In Sicily, there is much of the external restraint—the arm of the civil and ecclesiastical power; in the United States, there is more of the "internal" restraint. The quality of society and the school varies with the proportions of these two kinds of restraints. Sad is the moral condition of that school governed largely by external influences, since, upon their withdrawal, the individual revels among his accidental changes of feeling and fancy without control. These truths render it possible to account for the bad order not infrequently seen at the lecture room, at church, and in most public gatherings. Thus is general lawlessness accounted for—defacing public property, indecencies of speech, and want in self-respect. Too little attention is given to the fundamental principles of true discipline, and too much to the mere education of intellect. There is no honor in graduating an intellectual rascal. It is of but little consequence to require a student to memorize and repeat, at stated times, sickly formulas of self-government, and to frequently remind him of duty to himself and his fellows. But the student must be assisted to govern himself at that moment when desire would entice him from the path of rectitude, at the instant when emotion wars against the weakened will. Mighty is the chasm which separates the languid, non-effective knowledge that we should do right, from the trained ability to be upright, when temptation's hour approaches. All know that we should not embezzle the property of another, but the virtue implied in this statement becomes effective and useful to the individual only after he has resisted temptation (of one kind or another) time and time again. The simple knowing that we should reason confers no ability to reason—the intellect must engage oft and deeply in the reasoning process, to acquire that ability; likewise, the simple knowing that we should do right confers no ability to do right—the moral powers must engage oft and deeply in those processes which constitute a moral act, before the mind acquires that desired ability. It is almost unnecessary to say that the simple learning of moral truths is an education of intellect and not a training of the moral powers of a human being. In the correlation of feeling and intellect, I am

sure there is opportunity for research that will yield rich returns to an industrious explorer.

To return again to the intellect; an illustration: The eye falls upon a fruit-dish, and observations are made. After a lapse of a few minutes the word, "fruit-dish," suggests its peculiar form, its leaf designs, its fruit reliefs, its soft color, its position, its majolica material, its use, its grace and beauty and its slight defect. A week hence, its name suggests distinctly its form, its color less distinctly, and the details of its ornamentation with increasing faintness. A year hence, these scanty details have lapsed into no little obscurity, the name "fruit-dish" being as powerless to awaken original conceptions, in the fullness of their details, as Xenocrates' definition of soul: "A number moving itself." But what must be the significance of this term to a child who has even never observed one especially designed for the double purpose of ornament and for holding fruit? To strengthen this position, let me quote from an eminent educator, (Dr. Porter,) since teachers as well as other people rely more upon authority than upon their own common sense: "The impressions received from words, by one who has never witnessed the reality, are but as thin and pallid shadows, when contrasted with full and glowing intuitions." It must be admitted, then, that while the teacher's work remains among symbols, he handles a currency whose value is as shifting or changeable as the diversity of minds to which he appeals. These symbols form a redeemable currency, but not a currency that is oft redeemed. There is but one way for our educational systems to act in this matter, and that is to insist upon the evident necessity of the pupils first knowing the thing itself, then learning its name, followed up by a frequent reference of the symbol to the real object which that symbol represents. Only by this method can the increasing faintness of symbols be counteracted. Again, we teach by the use of symbols. Symbols of what? Symbols of former perceptions. Where have those experiences taken place? At the indulgent and perhaps wrangling home and upon the noisy, distracting street. Under what circumstances? By the merest accident and without careful examination; occurring among scenes of confusion or in moments of excitement; in hours of despondency, when emotion silenced the intellect; in a hap-hazard manner, when experiences are neither analyzed nor respectably put together and were forborne because unavoidable. Now, the question arises, "If the original experiences have been so imperfectly mastered, how can their symbols possess a high value? And if these symbols are the common currency of teacher and pupil who can longer wonder that the child's proggress is not only plodding but very discouraging? In view of these unrefuted facts, I fearlessly assert that no attempt at instruction is entitled to the name of system, or, is even tolerable, which does not provide for the systematizing and perfecting of experiences throughout the course of instruction. The corollary is sufficiently obvious; our schools must be provided with apparatus and specimens with which to reinforce the symbols, and, primarily, to furnish new experiences. Until those almost meaningless symbols, the sole possession of the average child

at its entrance into the public school, have a freshness and force which, in our teaching we constantly assume, we may expect a continuance of the parrot work of the school-room and the difficulties of comprehension. Sensation, perception and symbolization, both in logical sequence and mental development, are the successive phases which constitute the Archean principles of mental development and human progress.

If the above be taken for granted, how can our partial success in the school room be accounted for? There is but one answer. This partial success is mathematically co-ordinated with, and is strictly dependent upon, those incomplete experiences which the child already possesses. Furthermore, those new forms of knowledge imparted to the pupil in the school room are comprehended by him, or as yet remain obscure, according as their elemental symbols are significant or meaningless. If the experiences whose symbols we divide, combine and variously use, are fresh by repetition or late in time, the new knowledge product will stand out in bold relief; but if—as is more commonly the case—the original intuitions were incomplete for any reason, the new knowledge-product will be unreal, unsatisfactory, and nebulous. It should be added here that although the the pupil may recite text-book statements in well rounded periods, it is still far from being a test that he understands what he so beautifully says. Thus do we reach the conclusion, by the consideration of a few points in mental growth that "object teaching" is the only rational method of primary instruction. By "object teaching," I mean teaching from the objects and the phenomena themselves by allowing the pupil to handle and otherwise examine these objects, and not from drawings, nor pictures, nor verbal descriptions, nor enchanting stories about them.

(*To be continued.*)

MEDICINE AND HYGIENE.

HEALTHFUL AND DANGEROUS OCCUPATIONS FOR WOMEN.

In the city of New York or surburbs we find women employed in staining and enameling glass; in making glass signs; in cutting ivory, pearl, and tortoise-shell; working in gutta-percha, gum-elastic, and hair; making willow-ware and cane chairs; feeding printers' presses and setting type; making and packing candles; molding tablets of water-colors; assisting in the manufacture of chemicals and fire-works; making clocks, enameling dials, and painting the cases; finishing backgammon boards; making and dressing dolls and toys; stitching the cloths and making the pockets of billiard tables; painting the handles of brooms, and weaving twine into netting; making paper collars and twine; burnishing jewelry and making buttons. There are about five hundred millinery houses in the city,

employing over two thousand milliners, and the manufacture of straw hats engages several thousand women in weaving the braid, sewing, and bleaching. The artificial-flower trade employs about four thousand women, many of them French, and it is as lucrative to adept hands as any other. The manufacture of hoop-skirts is said to engage over ten thousand women, who spool the cotton, weave the tape and cover the steel; and the cap trade gives employment to many more thousands, whose earnings vary from three to five dollars a week. The weaving of hair cloth is also done by women, the packing of confectionery, and the making of shoe "uppers."

Some of these occupations, and others to which we have not referred, are dangerous to the operatives, not merely from the long hours of toil, the insufficient food, and the lack of proper ventilation in the workshops, but from the nature of the materials and the manner of fabrication. The artificial-flower makers, the gold-leaf workers, the button-gilders, the cigar makers, and the lucifer-match makers also suffer from the nature of their occupation.

In large manufactories of artificial flowers the ventilation is usually sufficient, and precautions are taken to prevent the inhalation of poisonous colors. But nearly all the brilliant leaves are made in the artisans' own home, a back room or an attic devoted to all the purposes of existence, and the arsenic that produces the spring-like vividness of color is diffused in the atmosphere and absorbed by the system. The fabric from which the leaves are cut is colored in the piece, Paris green, cold water, and starch or gum-arabic being used for the purpose. This liquid is spread by the fingers over lengths of fine calico or muslin, which are afterward beaten or kneaded by hand until they have an even tint. They are then spread out in frames to dry, and are next cut and shaded, the final process being their immersion in warm wax, and the removal of any loose color upon them. The detached particles float in the air, and are inevitably inhaled by the workers, whose handkerchiefs are speckled with dots of green blown out through the nose. Another operation, technically known as "grass-work," consists in the fastening of small glass beads or "dew-drop" to the artificial blades, which dislodges portions of the color, and leads to its inhalation. The consequences are variable. When the persons employed are cleanly in their habits, and keep their windows open, an occasional headache or an attack of dyspepsia is the most they suffer; but in other cases, all the symptoms of arsenical poisoning and revealed in eruptions of the skin, nausea, colic, and general debility.

In gilding metal buttons, mercury and nitric acid are used, producing their characteristic diseases; and in making lucifer-matches the work-women sometimes contract the terrible disease which is technically described as necrosis of the maxillary bones, many cases of which have been treated at Bellevue Hospital. In the preparation of gold-leaf the substance is so fragile and bouyant that the doors and windows are necessarily kept closed, and the air of the work-rooms becomes very impure. But the women who suffer most from the character of their occupation are the cigar-makers, who, mingling with men, boys, and children, toil

many hours a day for five or six dollars a week, living in an atmosphere surcharged with dust and fumes that would make the most inveterate smoker sick. Part of the work is done in factories, but most of it is done in the dwellings of the operatives, and in neither is any attention paid to ventilation or cleanliness. Growing girls at the verge of womanhood suffer in many ways, and are as much under the influence of tobacco as a constant smoker. Their faces are pale, and their eyes are dead; a stupor comes over them; their nerves are unsettled, and their lungs are diseased in nearly every case.—*Harper's Magazine for June.*

"TAKING THE TASTE OUT."

Almost everybody knows that a globule of castor oil may be so folded by a deft and quick hand between two tea-spoonfuls of lemon juice that only the acid is recognized in the taking, and that where acids may not be used, the same effect may be secured by wine or spirit. But everyone does not know that any powerfully pungent substance, masticated for a moment and rejected, will prevent the necessity of acid or of spirit, neither of which, of course, it is always best to give. Thus, a bit of lemon peel or of orange peel, if chewed half a minute, will render castor oil as innocent as water, and it will do the same for the quite as vile taste of balsam copaiba. A little bitter almond, too, has the same power, if not more of it; and a peach kernel is not quite useless in that way. Indeed, one drop of the essential oil of almonds will neutralize the disgusting quality of a whole ounce of castor oil, we are told, without detracting from its virtues, and less than a tea-spoonful of the oil of orange will work the same magic on an ounce of balsam copaiba. If, however, not any of these articles is at hand, some strong peppermint is very effectual. Even licorice will prevent the taste of anything that is very bitter from being perceived, and, strange to say, is the only sweet substance known that is capable of doing that. A pinch of the leaves of sage, either dried or green, of pennyroyal, and even of catnip, if not quite so strong, is yet very efficient. Something as good as all the rest, although to the child probably not quite as agreeable, is the scattering of a few grains of Cayenne pepper on the tongue, after whose biting sting neither aloes, nor salts and senna, nor colchicum, nor thoroughwort, nor soda, nor bromide of ammonia, nor anything else, in fact, however disgusting otherwise, will make the slightest impression. If children, as it is very likely, should prefer the taste of the medicine pure and unadulterated to the smarting of the Cayenne, there are some grown people, and among them especially those gentlemen who, seldom needing to take medicine, make a great fuss about it when they do, and to whom Cayenne is so pleasant and necessary that some of them always carry it about them, may be glad to avail themselves of the knowledge in any case of need.—*Harper's Bazar.*

COMMERCIAL VALUE OF SANITARY WORK.

In a recent lecture in New Haven on the value of sanitary work, Professor Brewer, of Yale College, reviewed at great length the causes and effects of plagues and pestilences that did so much to darken the history of Europe during the Dark Ages. He then traced briefly the origin of sanitary science and its benefits, as shown in a largely diminished death rate. And after pointing out the four great obstacles to sanitation—ignorance, filthy habits, selfishness, and indifference—he proceeded to show how sickness, especially avoidable sickness, tends to impoverish communities as well as individuals. In this connection he said:

"Every student of history and of political economy notices the wonderfully rapid accumulation of wealth and capital in modern times compared with what it has been in previous ages. The material wealth and working capital of the civilized world has more than trebled in less than a lifetime. The accumulation of wealth and property (and it is this which represents the aggregate savings from labor) during the last few years more than equals all that had been saved in all the thousands of years that had gone before, and that, too, while there has been a more general enjoyment of the comforts of life and a much greater indulgence in its luxuries. The nature and sources of this rapid growth have been the subject of much discussion by the statesmen and political economists. The causes generally assigned are the invention of modern machinery, the use of steam as a motor, the growth of modern means of transportation by sea and land, the application of the natural sciences to the arts and industries, the spread of popular education, the diminution of wars, and the production of the precious metals. There is no doubt that each and all of these have had their influence; but there is one still greater cause which is too often overlooked, simply because it is not so conspicuous. The greatest of all causes is to be found in the better average health of civilized countries, and the longer average term of life which is now secured to workingmen.

"It was not merely war, nor because they did not have steam, nor did not know about greenbacks, that kept the masses in poverty all through the Middle Ages—it was disease, and the death that came from disease that kept the nations poor. The history of the Middle Ages is a sad succession of plagues, of cities devastated, of States impoverished, of laborers swept away in millions, by successive waves of pestilence that followed each other as often as cities grew populous. Between the common sickness which was ever present and the pestilences which swept off their millions at a swoop, the average period available for actual labor in man was perhaps not more than half what it is now. Meanwhile, it took just as long to rear children to a working age as now, and sickness was just as expensive; so, between the diminished power of production, the waste by sickness, the panics and checks to commerce caused by plagues which were raging somewhere all the time, it is no wonder that wealthy people were compar-

atively few and the masses sunk in abject poverty. If we are tempted to think that we are saved from this by steam or machinery or increased production of the precious metals, let us look at any pestilence-stricken city of modern times. A single pestilence of but a few months came near bankrupting Savannah, and laid a check on her progress and a burden on her resources which it will take many long years to overcome. Worse still is the case of Memphis, with its two pestilences; and such may be the loss to any American city if it neglects sanitary laws. Our modern civilization is one of intense competition. Each producing community is now in a struggle with all the rest of the world as it never was before. If it have any special advantage, it may prosper; if it have any special disadvantage, it either lags behind in the swift race, or, by standing still, relatively declines, or else it goes under in the hard struggle of productive or commercial competition. And what heavier burden to bear than sickness! And yet this fact is liable to be overlooked or forgotten. The healthy man hopes that sickness will never come, and may be careless of his health, and the healthy community rarely awakens to danger until epidemic sickness sets in, and the loss is actually begun.

"It is the part of sanitary science to point out the dangers and suggest means of prevention, and when epidemics actually set in to suggest remedies; it is the part of sanitary legislation to provide means to apply these remedies; it is the function of health boards to administer them. But, from the nature of the of the case, the better they do their work the less obvious are their labors. The officer who heroically stands at his post during the time of pestilence, labors to stay its dread work, helps the suffering, and comforts the dying is a hero, and the heroism is of a kind that can be seen; no praise is too high. But the other officer who, by his labors, prevents the pestilence and keeps it so far off that the danger is scarcely seen, receives no such praise—too often in its stead criticism, opposition and indifference. It is because of the nature of sanitary work that its value in increasing the prosperity of a city is so often overlooked. In the ordinary pursuits of business, the clang of machinery, the brilliancy of the applications of science to the arts, the bustle of business, the romantic ways in which the precious metals have been discovered and won, are more conspicuously in the eyes of the public than the quiet, persistent, unromantic, but heroic fight with unseen but unwholesome influences which lurk in the air of our towns. These malicious influences, mostly growing out of our modes of life, are ever present in all our cities, ever growing unless checked, always producing disease, and from time to time especially inviting pestilence, as persistent as sin, as tireless as nature, and as pitiless as death. The rapid growth of town and city populations, as compared with the country during the last forty or fifty years has been made possible only by the power which modern sanitary science gives us to prevent, to check, and to combat epidemics. As matters were before, a pestilence of but a few weeks or months would put back the growth of a city for years. This city has had but one visitation of yellow fever; it lasted scarcely two months,

and, from all I can ascertain by a careful investigation of the matter, it took from eight to ten years to recover from the shock. Indeed, can we say that it ever recovered? What New Haven might have been, had it not been for that check, just at a time of rapidly growing commercial importance, we can never know, but that citizens left, with their capital, to go into business elsewhere, and never came back, and that trade left the place and never returned, is certain. What 'might have been' had this pestilence not fallen on us eighty-six years ago we can never know. What may be, if another pestilence comes, we know too well. Too many cities have had such a bitter experience, even in modern times, for us to be ignorant of the effects.

"We insure our manufactories from loss by fire to insure their being rebuilt if once burned. Even with this, the temporary suspension of work may drive trade elsewhere. Hence premiums are cheerfully paid to guard against the possible contingency, and before the conflagration comes we cheerfully purchase fire-engines and apparatus, and organize bodies of skilled men to use them when the emergency comes. Here it is recognized that all this, though expensive in the beginning, is cheap in the end, and yet how reluctantly any such means are ta ken to guard against a worse destroyer of our wealth and prosperity. The arguments used even by official bodies against adequate support of public health administration in many, if not most cities, are curiosities of inconsistency, and will be cited as such by the next generation. It must not be forgotten that health boards are now more strongly demanded and called for because of their pecuniary importance than because of their function in allaying human suffering or saving human life. So long as merely men died, and health was lost, and sorrow fell on thousands of homes, Memphis went on as of old, dug her cesspools deeper and more of them, and did without sewers, but when the loud voice of trade cried out, 'We can not afford to allow Memphis to longer stand as a menace to the commercial prosperity of the great Mississippi valley,' then, and not till then was a system of sewering begun. A high death rate means loosened vigor, lessened powers of production, a check on prosperity, a burden on industry. A low death rate in modern cities can only be secured by public sanitation, and by an intelligent and efficient co-operation of the public with an active board of health. A single epidemic but one-fourth as bad as that in Memphis last year would cost this city more, and leave us with higher taxes, that the most expensive system of sewers and of garbage collection than was ever dreamed of here. And there is nothing to prevent it but public sanitation. We had that very disease here once, and the city did not recover its prosperity for ten years, and it lost some phases of prestige which it never regained. An epidemic of small-pox a few years since lost to the city of Philadelphia, in ways which could be estimated, above $20,000,000. This city a little later was seriously threatened with a similar epidemic, which was effectually stayed, and the health officers were, perhaps, more severely criticised for their work than for any other thing they have ever done. The results, however, have amply demonstated the wisdom of their action.

"The fact wants to be kept before the public, that as production and commerce and trade are now carried on, few cities can afford to allow a pestilence to invade them. And if it comes to a city, with the natural advantages of soil and climate we have, it is due either to official ignorance or public neglect. There is, perhaps, not a single kind of pestilence which has afflicted any civilized city of temperate climate during the Dark Ages or since, over which we have not now control, if the community act up to the light and knowledge we have; and on the other hand, as business is now carried on, no city can now be afflicted as many then were, and not be bankrupted and financially ruined.—*Scientific American Sup.*

FOR DIPHTHERIA.

A physician in Illinois writes: I have used successfully the following for some years for diphtheria: ℞ sulphite soda gr. x., dissolved in ℥i. warm water. Then add ten gr. salicylic acid. Dose, teaspoonful every fifteen to thirty minutes (or oftener) to a child of two years. At the same time use beef tea, wine, eggs, quinine, etc. I find this an effective anti-zymotic. In bad cases it must be used for some days.

CHLOROFORM VAPOR IN EARACHE.—At a recent meeting of the Medical Society in the District of Columbia, Dr. James E. Morgan stated, during a discussion on otitis, that he had often promptly relieved the distressing earache of children by filling the bowl of a common new clay pipe with cottonwool, upon which he dropped a few drops of chloroform, and inserting the stem carefully into the external canal, and adjusting his lips over the bowl, blew through the pipe,—forcing the chloroform vapor upon the tympanum. Dr. J. Ford Thompson has also accomplished the same relief upon similar principles.

GEOGRAPHICAL NOTES.

THE HOWGATE EXPEDITION.

The vessel selected and furnished for this expedition is a Clyde built iron frame propeller, 200 tons burden, 140 feet in length, 21 feet 6 inches breadth. The engine has two 30-inch cylinders, each 24 inches stroke, jet condensers, and one boiler. The engine is estimated to be of about 200-horse power. The works have been overhauled and put in complete order by Petitt & Dripps, machinists, Washington, D. C.

It has been greatly strengthened by filling in 2½ inches oaken plank between the iron frames, sheathing inside and outside with stout oaken planks, so as to make the hull uniformly 15 inches thick. To guard effectually against the nip or pinch of the ice, which sometimes crushes in the sides of a vessel as easily as an egg shell, the inside of the hull has been braced with extra heavy white oak timbers placed horizontally, and from side to side in the various compartments of the ship, directly on the water line. Inside the prow three heavy white oak breast hooks have been placed, and on the outside of the bow, over all, is a sheathing ⅜ of an inch iron armor, extending 10 feet deep and 14 feet aft from the stern.

Capt. H. C. Chester, formerly of the Polaris expedition, who is an experienced and intelligent Arctic explorer, has superintendence of the work of fitting the Gulnare for service in frozen seas. He has placed on the sides of the vessel extending above the water line, wedge-shaped oak timbers, which are calculated to ease the vessel upward when pressed by heavy ice. This is an idea resulting from the experience of the Polaris, which, when caught in the pinch of the ice, was forced downward and crushed. A new main deck has been put on, the planks being bolted to the iron frame of the ship, and secured on the inside by nuts screwed to the bolts. A new smoke-stack and an extra propeller have been provided, and amidships will be placed a new bridge 21 feet long.

As the Gulnare will be used primarily to found an arctic colony of observers, to be recruited by other explorers hereafter, one of the chief designs in preparing the vessel for service has been to secure all the storage room possible for provisions, materials, instruments, arms and munitions. On the deck will be carried the frame work and other parts of a complete house sixty feet long by twenty feet wide, built on the plan of the houses so long employed by the Hudson Bay Company. This house has been put up temporarily in Washington on the vacant lot on Fourteenth street, near New York avenue. It is a complete double frame house, with 12 or 14 inches space between, so as to afford the protection of an inner wall of caloric. All the pieces are marked and numbered, and when taken apart may be stowed in a small space, and afterward put together readily by the arctic colonists. Window frames and glass to give light, stoves for heating, lamps and other necessaries will be carried sufficient for a company of men at the polar station, as well as for the ship's company on the voyage.

In the forward part of the Gulnare is the forecastle, or berth deck for the seamen. There are accommodations for twenty-five men in this part of the ship, but the quarters will be very close. Under the berth deck is a fresh-water tank and storage room. Between this compartment and the coal bunkers, near the engine, the hold is entirely given up for storing supplies. The engine, boiler and coal of course occupy the center of the ship. Aft of these is the cabin, which is a neat and cosy little apartment, with state-rooms on each side, with accommodations for 18 officers and scientists. In the hold beneath the cabin is

room for storage. When completely fitted out the little vessel will be closely packed with material and subsistence stores, and it is expected her complement of officers and crew will aggregate upward of 40 souls.

In addition to steam power the Gulnare carries main and foremasts, which have been put in new, with new spars, cordage, etc. The rigger is J. W. Williams, 106 Thames street, Baltimore. Pollard & Padgett, sailmakers, Alexandria, Va., have made duplicate sets of new sails entire. The vessel is square-rigged forward, square foresail, topsail and gallantsail, lug 4½ foresail; the main is schooner-rigged and gaff topsail. No pains or expenditure has been spared to insure the best outfit and the most serviceable material.

The station to be established in the Arctic region will be on the north side of Lady Franklin bay, in 81½° north latitude, near a coal deposit found by Nares' expedition. The landing party will be in charge of an officer of the United States Army. The expedition will be commanded by United States navy officers, and the crew will be selected also from this branch of the public service. Capt. Howgate, whose idea is being put in practice, will remain here at the base of supply to look after the sinews of war and to direct operations in the advance on the heretofore sealed region of the north pole, which will be made with a steady and systematic persistency which must win in the end, and finally gain for our countrymen the renown of having overcome the frozen barriers with which nature has hemmed in this interesting and forbidden region.

When the men and material which the Gulnare now carries out have been landed and their house has been put up and supplied this summer, the steamer will return to the temperate zone for more supplies and men to replace those who may have become disheartened or disabled. From the colony first planted, expeditions will be sent out and a series of continuous advances made by planting camps further and further northward, until at last the main object is attained. But the glory of reaching the north pole over all obstacles, and over all other peoples who have striven for many years in this fascinating adventure, is not alone the object of the Howgate expedition. There are other and higher aims in the interests of science and knowledge, the fruition of which will be developed in the future of that intelligent corps of public servants, whose ceaseless watch and scientific industry already enable us to protect some of the most important pursuits in life, as well as the individual health and comforts. While the struggle to advance further over the frozen steppes and icebergs of the north will never cease, the time consumed will not be lost otherwise. Each day will have its duties peculiar to the region, in the fight to live as well as in the observation and recording of natural phenomena, and in practical siege of the north pole, which is to be instituted in this system of steady and gradual approaches.—*Baltimore Sun.*

ARCTIC RELIEF.

The following instructions to the commander of the Revenue Cutter Corwin, explain themselves :

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
WASHINGTON, D. C., May 15, 1880.

Captain C. L. Hooper, Commanding Revenue Steamer Corwin, San Francisco, Cal.:

SIR—The department having determined to dispatch the revenue steamer Corwin, under your command, to cruise in the waters of Alaska for the enforcement of the provisions of law and protection of the interests of the government on the seal islands and sea otter hunting grounds and of Alaska generally, you are directed to take on board that vessel, without delay, supplies of provisions for a six months' cruise and sufficient quantities of fuel and water and leave San Francisco with your command not later than the 22d inst., for the waters named and make the best of your way to the places hereinafter designated.

It is desirable that you should be in Behring Sea and the Arctic Ocean as early in the season as the opening of navigation will permit. You will accordingly proceed from San Francisco direct to Ounalaska, and on arrival there will take in a fresh supply of coal. From this point you will proceed to Norton Sound, touching at the seal islands on your way. You will leave an officer and two men on Otter Island for the purpose of protecting the seals there, unless you should deem it necessary to take all your command with you in your further cruise to the northward.

It is expected that you will time the movements of your vessel so as to arrive in Norton Sound before Behring Strait is open for the passage of vessels, and that you will avail yourself of the first opportunity to push into the Arctic Ocean. Arrangements have been made by which the Alaska Commercial Company will place about fifty tons of coal at a convenient point on this sound, from which you may replenish your supply, if found necessary, at any time during the season.

By reference to the report of Captain George W. Bailey, United States Revenue Marine, who commanded the revenue steamer Rush, in her cruise last year in Alaska waters, you will observe that Kotzebue Sound, in the Arctic Ocean, is reported as the rendezvous of a number of vessels engaged in illicit traffic with the natives of Alaska in rum and fire-arms. You will use your utmost endeavor to apprehend any such vessels as you may find thus engaged and break up their illegal trade.

It has been reported that two whaling barks, the Mount Wollaston and Vigilant, were probably caught in the ice within the Arctic Ocean last Autumn while endeavoring to return through Behring Strait from their season's whaling, and fears are entertained for their safety. You will make diligent search for said vessels, and should you fall in with either of them or with any of their officers or

crews, you will afford such succor or assistance within your power as may be required. Should any persons desire to send contributions of provisions, etc., for the relief of those whalers, you will receive the same and dispose of them in such manner as circumstances may require.

You are further instructed while in the Arctic to make careful inquiries regarding the progress and whereabouts of the steamer Jeannette, engaged in making explorations under the command of Lieutenant Commander De Long, United States Navy, and you will, if practicable, communicate with and extend any needed assistance to that vessel.

Should you be able to accomplish your mission in the Arctic Ocean early in the season, or find it necessary in carrying out these instructions to return to the seal islands before the usual time (say October 10) for the return of the revenue steamer from those waters, you will make a cruise to the westward from Ounalaska as far as Atton, with the general object of protecting the seal otter hunting grounds and breaking up the business of illicit traders who frequent those waters. You are, however, permitted in your discretion to remain in the Arctic Ocean as late in the season as may be necessary to accomplish the object of your voyage without encountering undue hazard to your command.

A rumor of the wholesale starvation of the inhabitants of St. Lawrence Island, in Behring Sea, is noticed by Captain Bailey in his report of last year. You will investigate the facts regarding the matter if opportunity offers, and will, if practicable, land upon that island and ascertain the number and real condition of said people.

While cruising in the Arctic Sea you will make careful observations as to currents, tides, etc., and will keep an accurate record of such soundings, surveys, etc., as you may be able to make, and you will obtain such information as may be practicable regarding the numbers, character, occupations and general condition of the inhabitants of the adjacent coasts.

Previous to sailing from San Francisco you will forward to the department a muster and descriptive roll of the officers and men of your command.

You will whenever opportunity presents transmit to the department reports of the progress of your cruise.

In conclusion, the department, having defined the general objects of your voyage and relying upon your skill and good judgment, confides to your discretion the details of your cruising within the Arctic Ocean, and takes pleasure in wishing you a prosperous voyage and a safe return. Very respectfully,

JOHN SHERMAN, Secretary.

AWARD OF THE ROYAL MEDALS OF THIS YEAR.

The Royal medals or premiums intrusted to the Society by the Crown "for the encouragement and promotion of geographical science and discovery," have this year been awarded as follows:

The Founder's (King William IV.) medal, to Lieut. A. Louis Palander, in recognition of the services rendered by him to geography, as commander of the Vega in the late Swedish Arctic expedition, during which he safely navigated the vessel along the unsurveyed shore of the Asiatic continent for nearly 3,000 miles. The Patron's, or Victoria medal, to Mr. Ernest Gills, for leading four great expeditions through the interior of Western Australia in the years 1872–6, during which 6,000 miles of routes were surveyed, and 20,000 square miles of new country discovered.

PUBLIC SCHOOL PRIZE MEDALS.

The medals for geographical proficiency annually offered by the Royal Geographical Society to the leading public schools have this year been awarded as follows:

Physical geography gold medal, to David Bowie (Dulwich College). Silver medal to Albert Lewis Humphries (Liverpool College). Honorably Mentioned, G. I. Schorstein (City of London School,) S. Edkins, (City of London School), P. J. Hartey, (University College School), H. McMasters (Liverpool College), R. G. Reid, (Dulwich College).

Political geography, gold medal, Frederick James Naylor (Dulwich College). Silver medal, Theodore Brooks, (London International College). Honorably Mentioned, C. F. Knaus, (Dulwich College), C. E. Mallett, (Harrow School), W. H. D. Boyle (Eaton College), A. D. Rigby (Liverpool College), M. G. Grant (Liverpool College), C. J. Casher (Brighton College). The special subject this year was Western Africa, between the Sahara, the territory of Egypt, and the 6th parallel of south latitude. The examiners were, for Physical Geography, Commander V. L. Cameron, R. N.; for Political Geography, Admiral Sir Erasmus Ommanney, C. B., F. R. S. The examinations were held on the 15th of March.

ITALIAN EXPLORERS IN AFRICA.

Dr. P. Matteucci, who has not long returned from Abyssinia, has already, as we learn from Cora's 'Casinos,' started on a third expedition into Africa, with the object of exploring the little known State of Wadai, our present knowledge of which depends almost wholly on the information collected by Dr. Nachtigal. Dr. Matteucci is accompanied by Don Giovanni Borghese, son of Prince Borghese, at whose cost mainly the expedition has been fitted out, and Lieutenant A. Massari, as scientific coadjutors The travelers visited Cairo in February last and were furnished with copies of the surveys executed by Egyptian staff officers in Darfur, and on the part of the Khedive with letters of recommendation to the Sultan of Wadai. The routes to be taken by the expedition is via Suakin, Berber, and Kharturn; and they started from Sully on the 24th of

February last. Respecting the fate of the travelers Chiarini and Cecchi, who left the kingdom of Shoa, two years ago with the intention of proceeding through Kaffa to the African equatorial lake region, the Italian authorities are still in some uncertainty. The last intelligence respecting them was to the effect that they had both reached the town of Kaffa in February, 1879 in good health, had been well received by the king, and were on the point of continuing their journey to the lakes. Since then no further news has been received, and considerable uneasiness prevails, owing to the hostile attitude of the Mohammedans in those parts.

MISCELLANEOUS.

MAKING AND PRESERVING LAWNS.

BY WALTER ELDER.

To properly make a lasting lawn, and keep it in good order, taxes the highest skill of the horticulturist, and when well executed, is the masterpiece of ornamental gardening. Without it all other improvements look insignificant. It forms the green carpet upon which all ornaments are to be placed, and its bright verdant hue imparts beauty to all.

Instructors upon lawn making, generally advise subsoiling the ground. If this be done, it should be a year previous to laying down the lawn. It is not always best to do it, as the subsoil may be a stiff clay, or barren sand. I have seen subsoil brought to the surface so poor that not even beans, peas or corn would grow—the germs rusting and decaying away. The seeds of grasses are small and succeed best in mellow and fertile soil. Several species of grasses should be sown, and very thickly, to make a close, green turf. Red top or herd grass, blue grass, orchard grass and a little white Dutch clover. The land should be manured the the previous year to sowing the grasses. After digging or plowing, harrow or rake fine, level up all hollows, and roll firmly down. Then sow the grasses, rake fine or harrow, then roll again. The sowing time will be according to climate and latitude. Between New York and Baltimore, say from early March to middle of May, and from early September to early in October, and all the Fall after that. When grasses and weeds are well up, roll well, and let them all grow until the earliest weeds shoot up flower stalks, then mow down with the scythe or horse-mower, and scatter the cuttings evenly over the surface. When they wither, roll again, and then rake all off. On sandy lands the summer mowings should be seldom. On sloping lands and terraces or banks, the grass should be let grow long in hot, dry weather, unless artificial watering is at hand. The lawn should not be weeded the first year, but cut down all weeds when they

bloom to prevent them bearing seeds. Weeds may be all taken out in late fall, and more grass seeds sown. Men with table knives can get out a vast number of weeds in a short time. A thorough digging out of weeds, with table knives, will keep the lawn nearly clean. Do it in late fall or early spring. The lawn should be firmly rolled down every spring. It is good to sow some more grass seeds in late fall or early spring, so as to insure a close turf the next summer.

Barnyard manure, so fermented and rotted as to kill all seeds of weeds in it, is the best fertilizer. It should be spread equally over the surface in fall or winter, as it is a most excellent fertilizer, when applied at the rate of five to ten bushels to the acre. Marl mixed with plaster of Paris is beneficial on sandy lands. Guano, and all the concentrated fertilizers are good, but their effects are different upon different lands. Lime, wood ashes and stone coal ashes should all be compounded with soil a year before using, and spread over the lawn in the fall.—*Gardener's Monthly.*

BALM OF GILEAD.

Dr. De Hass gives the following particulars as to this far-famed specific for all diseases: The name of Gilead was sometimes applied to all trans-Jordanic Palestine; properly, however, it included only the country east of the Jordan from the head of the Dead Sea to the foot of the Lake Genesareth, of which Mizpeh Gilead was the crowning point. It was here, along the Jordan and about Jericho, the balsam or balm once so highly prized, was procured from an aromatic tree, supposed still to be found in this region, and known as Spina Christi, or tree from which the Savior's crown of thorns was woven. This most precious gum was obtained by making an incision in the bark of the tree; it also oozed from the leaves, and sometimes hung in drops like honey from the branches. The tree which originally was found in Palestine, was transplanted to Egypt by Cleopatra, to whom the groves near Jericho were presented by Mark Antony. The shrub was afterward taken to Arabia and grown in the neihgborhood of Mecca, whence the balsam is now exported to Europe and America, not as balm from Gilead, but balsam from Mecca. The gardens around Heliopolis and the "Fountain of the Sun," in Egypt, no longer produce this rare plant, and it has long since ceased to be an article of export from the ancient Gilead.—*Journal of Chemistry.*

SEEING BY ELECTRICITY.

As regards the general question of seeing by electricity, the principles involved are somewhat different from those which have entered into other electro-telegraphic problems; the element of *time*, which plays such an important part in all telegraphic inventions hitherto brought out, is almost wholly absent when the question of sight is involved. In the transmission of sound, or of telegraphic signals by electrictlty, we have to cause a succession of signals to follow one

after the other, and hence it follows that a single telegraphic wire is able to effect all that is required. In the case of *seeing*, in order to enable the form and color of an object to be rendered evident to the senses, it is necessary that a series of impressions, infinite in variety, be produced upon the retina in almost immeasurably short space of time, and, practically, all at the same instant; we must have, in fact, an infinite series of waves transmitted at the same, or nearly the same moment. To do this through a single wire by electrical means is a difficult problem; but that it will eventually be done by means of a single wire, is, we think, an undoubted fact. How it is to be done is another question; but we feel certain that no arrangement involving a multiplicity of wires will ever enable success in the direction aimed at to be attained. It is not because a multiplicity of wires is objectionable for practical telegraphic purposes that we say this; but, because, almost without exception, all complete solutions of problems, like that of the telephone, for example, have been most completely and thoroughly effected by the simplest means.—*Telegraphic Journal.*

THE RELATION BETWEEN INSECTS, PLANTS AND MAMMALS.

BY LESTER F. WARD, A. M., WASHINGTON, D. C.

It is a fact of profound significance that the higher flowering plants made their first appearance on the globe simultaneously with the *Hymenoptera* and *Diptera* in the Jurassic and Cretaceous formations, while they did not reach their highest perfection until the *Lepidoptera* had appeared in the early Tertiary. The *Neuroptera* and *Orthoptera* which are found in the Carboniferous could have contributed nothing to the demand for cross-fertilization, and the *Coleoptera*, sparingly met with below the Trias, were doubtless then equally ineffectual in this respect; as even at present they only supplement to a slight degree the work of the bees, flies, moths and butterflies. And we accordingly find that the vegetation prior to the Jurassic and Cretaceous epochs consisted almost wholly of Cryptogams and Gymnosperms, with only a few amentaceous and monochlamydeous Angiosperms in the highest of these strata.

These facts justify the assumption that most of the higher flowering plants would speedily perish were insect aid withdrawn, and also that but for such aid in the past we should now see, instead of our gorgeous flora of Orchids, Lilies, Magnolias, and Roses, one consisting chiefly of Ferns. Cycads, and Conifers, mingled with willows, oak, and alders, and plain grasses and rushes.

But when we consider how poorly adapted Cryptogamous and Coniferous vegetation is to the support of animal life, we may also declare with perhaps equal certainty, that but for the *Phænogamia* there could have been no *Mammalia*. A picture that should represent herds of buffaloes and antelopes roaming amid the Ferns, Lepidophytes, and Calamites of the Carboniferous epoch would be an

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anachronism whose realization it would be impossible to conceive. And thus we have, only on a grand scale, one of those singular chains of cause and effect of which naturalists have pointed out several (that of the dependence of clover upon cats, being perhaps the most familiar), but which, apart from that grotesqueness which they sometimes possess on a superficial view, are among the best illustrations of that intimate and far-reaching *consensus* which prevades all departments of life.

Considering to what extent man is dependent upon the *Palmaceæ*, *Rosaceæ*, and other fruit and nut-bearing trees and plants, which, at least on the theory of man's simian origin, must have been far greater if not absolute in the early period of his existence; considering, too, in connection with this, that it is the *Hymenoptera* that have contributed most to render the existence of this class of vegetation possible, it ceases to be a mere poetic fancy to claim for the bee and the ant the high merit of having literally prepared the way for the advent of man, whose prototype they are to so great an extent, both in their psychic and their social attributes. * * * * * * —*American Entomologist.*

MAY JEWS EAT OYSTERS?

A certain elder of the Hebrew Church in America recently propounded the doctrine that oysters are "plants," and are not, therefore, included among any of the articles prohibited as food under the Mosaic law. He probably based his remarkable discovery on the difficulty which modern research has thrown in the way of accurately determining the line which divides animals from plants. Some of the members of his church appear to accept the doctrine, and have become habitual eaters of oysters; while others maintain that these bivalves are "unclean," and avoid them accordingly. A question of extraordinary delicacy is thus opened up. The different views on the subject of those who do not accept the "plant" theory, may be expressed in the following manner. Among the various "unclean" animals enumerated in the Levitical law, those creatures of the water "that have neither fins nor scales," are specifically mentioned, and it may be argued that oysters do not come within this category, for do we not speak of green finned oysters? and are not the shells virtually "scales"? On the other hand snails are specifically forbidden, and it is claimed that oysters are really snails? but then snails might be said to be covered by the prohibition of "creeping things," and those that "go upon the belly," so that the mention of snails ought not to be taken as including more than those particular creatures.

Altogether the problem is as delicate as it is curious and interesting. It ought, however, to be met fairly, and settled authoritively. To call an oyster a "plant," for the purpose of evading the generally accepted rendering of the Mosaic law is begging the question altogether.—*The Caterer.*

RECENT TELEPHONE EXPERIMENTS.

At the suggestion of one of the proprietors of this Journal—Mr. A. E. Beach—a series of interesting experiments relating to the electrical transmission of sounds has lately been commenced in this vicinity, which seems likely to lead to a variety of useful results. In the introductory experiment the *Scientific American* office and Mr. Beach's dwelling, in the upper part of this city, were connected by wire with the auditorium of Plymouth Church—Rev. Henry Ward Beecher's—in Brooklyn, N. Y., and these points were also telegraphically joined by the wires of the Bell Telephone Company and those of the Gold Stock Com pany, the electrical circuit being thus enlarged and ramified in all directions, communicating with offices and dwellings in New York, Brooklyn, Jersey City, Newark, Orange, Elizabeth, Yonkers, and other adjacent places. One object of the experiment was to determine approximately through how many united circuits and lines the voice of a public speaker might be simultaneously transmitted.

At Plymouth Church, in Brooklyn, the wire passed under the floor to the platform or pulpit, where it connected with two of the well known Blake transmitters arranged upon a shelf under the speaker's desk. The general arrangements for the experiments were under the charge of Mr. Fredrick C. Beach, Ph. B., of the *Scientific American* office.

When it became known at the Bell telephone office in Brooklyn that experiments were to be tried, the interesting news soon spread to all other telephone offices, and the various operators not only called into their offices parties of their friends to enjoy the treat, but gave notice to numbers of private persons having communicating wires, who in turn invited friends to their dwellings. Thus at many points on the great ramification of connecting wires were groups of persons waiting, with telephones at their ears, to hear the words of the distinguished speaker. At one of the stations fifteen telephones were in this way connected, the instruments being joined by wires, just as a circle of people join hands in sharing an electrical shock.

The first experiment was made on Sunday, April 18, and was on the whole perhaps more successful than could have been expected. The telephone listeners stationed in Brooklyn, and nearest the church, were enabled to hear the service with much satisfaction; but those in New York, Yonkers, and Orange, N. J., only heard the music and portions of Mr. Beecher's sermon. It was concluded on the whole that there were too many telephones in circuit; and it was subsequently ascertained that the wire leading to the church had been surreptitiously tapped where it passed over a dwelling, a ground made on the tin-roof, and a considerable number of telephones smuggled in.

On the following Sunday, April 25, another trial was had, precautions having been taken not to allow so many tapping lines or instruments in circuit. Special care was also taken by Mr. Adee, the adjuster of the Bell Telephone

Company, to give the most delicate adjustment to the transmitting instruments at the church. The result was most successful and marvelous.

From the opening note of the organ prelude to the last word of the preacher's voice, at the close of the service, everything was delivered to the ears of the listening telephoners in the most perfect manner, the tones that came over the wires being so full, round, and clear, and distinct, it almost seemed to the hearers in New York, Yonkers and Elizabeth as if they were stationed within the church itself directly in front of the speaker.

The delivery of the music was equally perfect, every note of the organ and of the individuals of the choir being fully brought out. The majority of the participators in this experiment were persons accustomed to the use of the telephone, and their unanimous verdict was that the results obtained far surpassed anythlng of the kind within their previous experience.

These experiments proving successful, several new improvements have been suggested for trial, and there seems to be every probability that in a short time some new and very effective instruments will be in use, by which all who desire may carry the sounds of church services into their dwellings, and may also enjoy the best lectures, musical and other entertainments with the utmost satisfaction in their homes. Heretofore, in listening to the telephone, it has required effort and strain of the ear on the part of the listener. But this experiment shows that all sounds may be delivered in full and easy tones, readily heard, with all the natural characteristics, modulations, and inflections of the human voice.—*Scientific American.*

BLACK INK FOR STENCILS.

The following is commended for the preparation of a black ink or paste for use with stencils: Bone black 1 pound, molasses 8 ounces, sulphuric acid 4 ounces, dextrine 2 ounces, water sufficient. Mix the acid with about two ounces of water, and add it to the other ingredients previously mixed together. When the effervescence has subsided, enough water is to be added to form a paste of convenient consistence.

BOOK NOTICES.

WATER ANALYSIS FOR SANITARY PURPOSES. By E. Frankland, Ph. D., D. C. L., F. R. S. Philadelphia, Presley Blakiston, pp. 149. $1.

In view of the rapidly increasing population of our cities, and the corresponding increase of the contaminating materials, formed in factories, chemical works and households, which flow into our streams or filter through the soil into our springs and wells, it is of the utmost importance that the people should be informed how they can test their drinking water for unwholesome ingredients. This is the object of Dr. Frankland's little work, which, while strictly scientific and technical, is at the same time written in such a style as to be readily understood by ordinary readers. Part I, is devoted to water analysis without gas apparatus, including the preliminary examination of samples, solid matter in solution, ammonia, chlorine, hardness, nitrogen, poisonous metals, organic impurities, etc. Part II, is devoted to water analysis requiring gas apparatus, including the determination of carbon and nitrogen in organic matter by the combustion process, the eudiometrical determinations, interpretation of the results of combustion, sewage or animal contamination. The appendix (40 pages) contains lists of reagents, tables, typical analyses, etc., closing with the conclusions and recommendations of the Rivers Pollution Commissioners of England.

Physicians, sanitary commissioners and boards of health will find it a "handy volume" in their work.

MISSOURI UNIVERSITY LECTURES. By Members of the Faculty, 1878–9; Course II, Vol. I, pp. 504. Statesman print, Columbia, Mo.

In 1877–8, the Faculty of the Missouri University inaugurated the delivering of a series of lectures illustrative of the various special departments, which was found to be a decidedly popular move. During the past winter a second course was delivered with similar favorable reception by both students and the public, to whom they were made free. They were afterward brought together and published in a neat volume for general distribution.

The table of contents is as follows: Petroleum, by Prof. Schweitzer; Evolution and Creation, by Prof. Swallow; Insect Ways, Prof. Tracy; Mathematics, Prof. Ficklin; Three Pronunciations of Latin, Prof. Fisher; Mosaic Cosmogony, Prof. Meyrowitz; Linguistic Curiosities, Prof. McAnally; Arnold of Rugby, Prof. Bibb; The Professional school, Prof. Lowry, The Ideal of Art, Prof. Bingham; Metaphysics, Prest. Laws; Advantages of Classical Study, Prof. Fleet; Study of Language, Prof. Blackwell; Art, Prof. Diehl.

Some of these have been published in the REVIEW, others have been quoted from or commented upon; all are excellent and the work is worthy of the wide circulation that it has received.

DWELLING HOUSES. Their Sanitary Construction and Arrangement. By Prof. W. H. Corfield, M. A., M. D. (Oxon.) D. Van Nostrand, New York. 18 mo. pp. 156, 50 cents.

This is Number 50 of Van Nostrand's Science Series, reprinted from Van Nostrand's Engineering Magazine, and is a very valuable, practical essay, by a distinguished architect and professor of the University College, London, upon a subject of absorbing interest to all classes of society.

Situation and construction of houses from foundation to roof, including drainage, ventilation, heating and all other points, are fully considered and discussed from a scientific and common sense standpoint, and the little volume presents a competent guide to the builder and owner of dwelling houses. A few pages from it were published in the REVIEW last year and attracted marked attention.

OTHER PUBLICATIONS RECEIVED.

Twelfth and Thirteenth Annual report of the Peabody Museum of American Archæology and Ethnology, Vol. II. Nos. 3, 4; Proceedings of the Davenport Academy of Sciences, Vol. II. Part II. July 1877 to December 1878, and Vol. III. Part I. January 1, 1879; Proceedings of the Thirteenth Annual Session of the Missouri Press Association, held at Columbia, Mo., May 1879, To The Rockies and Beyond, being an account of the health, pleasure and hunting resorts of the mountain regions of the West, by Robt. E. Strahorn, 50 cents; The California Architect and Building Review, Vol. I. No. 5, monthly, $1.50 per annum; The William Jewell College Student, Vol. I. No. 1, $1 per annum; An account of the Tornado of Marshfield, Mo., April 18, by Prof. F. E. Nipher.

EDITORIAL NOTES.

ON Tuesday evening, May 25th, the Kansas City Academy of Science held its fourth annual meeting. A very interesting paper was read by Dr. Heath, of Wyandotte, Kansas, upon Orton and Peru, which will appear in the REVIEW next month. Judge West followed with his report of an exploration of ancient barrows in Kansas, which appears in the present issue of the REVIEW. A resolution was passed, thanking the various lecturers of the extra Winter Course for their aid and the pastors of the churches used for their courtesy, and the railroads furnishing free transportation; after which an election of officers for the ensuing year was held.

THE extra winter course of lectures furnished by the Kansas City Academy of Science was closed on the 22d ult. by that of Rev. Dr. Laws; and in most respects it has proved a success. The lecturers have been selected from among the best teachers and writers of Missouri and Kansas, and the topics treated by them have been of popular interest and suited to the most diverse tastes. The audiences have been in most instances quite large, and in all from among our most intelligent people.

The Academy has been at great trouble and some expense to secure the services of these gentlemen, to obtain the use of various churches in the city and other necessary matters, but if our people have been entertained and benefited enough to ask for a similar course next winter it will be forthcoming.

AMONG the later inventions few present points more worthy of consideration among metallurgists than that of employing the electrolytical process of refining the precious metals. It has been patented by E. André both in the United States and Europe, and is in practical use among some of the largest works in Great Britain and on the Continent. This process is said completely and economically to extract the gold and silver from their alloys, leaving the former in the diaphragms at the anodes and depositing the baser metals in a pure metallic state on the cathodes.

As an evidence of the importance and value of the U. S. Signal Service observations and predictions, it may be stated that the verifications of the latter, based upon the former, for the month of March, 1880, amounted to 82.3 of the whole number of predictions made.

SIGNOR N. Perrini, an Italian teacher of astronomy in London, has invented a new planetarium which is free from most of the objections to the old fashioned orreries, whose multiplicity of conspicuous wires and other machinery was liable to confuse the observer. Signor Perrini has his planetarium in a large circular room with a concave dome upon which the movements of the sun, moon and stars, &c., are distinctly and correctly shown by means of motive power which is out of sight above the ceiling.

AN important law suit now pending in the courts of Wisconsin involves the exact and probably speedy solution of the vexed question of the agency of wind or electricity in cyclones. The plaintiff sues an insurance company to collect pay for damages done to his property by a noted storm in 1878; basing his claim on the allegation that the storm was of electrical origin and therefore that the company is liable under the "lightning clause" of his policy. Of course the company resists payment on the ground that the property was destroyed by wind alone, regardless of the agency of electricity.

THE lecture of President Laws on the evening of the 22d, upon the Categories of Kant, was a clear, thoughtful and complete account of the philosophy of that wonderful metaphysician, with appropriate comments and just criticisms. It occupied the attention of the audience for over an hour and a half without any evidence of weariness, and when the speaker closed his remarks he was warmly congratulated by numbers of those present. As a lecture proper it was one of the most instructive and valuable of the course which it ended.

THE REVIEW for July will contain, among other original articles, the paper, by Dr. I. D. Heath, upon "Orton and Peru;" also one on the Ancient Mounds and Remains at Madisonville, Indiana, by the well known Archæologist of the Smithsonian Institution, Stephen Bowers, Esq., both of which will be especially attractive and interesting to all readers.

THROUGH inadvertence, we failed to notice the lecture of Rev. Richard Cordley, D. D., before the Kansas City Academy of Science, on April 13. It was upon the subject of Patience in Culture and Investigation, which was discussed in an able, discriminative and eloquent manner, worthy of the man and the occasion. It was expected that an abstract of the essay would be furnished for publication, but we suppose Dr. Cordley's well known modesty deterred him from doing this.

WE are indebted to Rev. James Marvin, Chancellor of the University of Kansas, for an invitation to attend the examinations and Commencement exercises of that institution, between May 31st and June 9th. Railroad fares have been reduced, and everything will be done to render the occasion especially interesting to visitors.

Columbia College has conferred upon General Di Cesnola the honorary degree of LL. D., in token of appreciation of his eminent services in the cause of art.

THE closing and Commencement exercises of the Missouri State University occupy the time from May 25th to June 3d. On Tuesday evening, June 1st, Gardiner Lathrop, A. M., LL. B, of this city, will deliver the annual address before the literary societies. This, as well as the other exercises, will be of a most interesting character.

ITEMS FROM THE PERIODICALS.

THE June number of *The North American Review* contains "Popular Fallacies about Russia," by E. W. Stoughton, ex-Minister to Russia; "Divorces in New England," by Dr. Nathan Allen; "McClellan's Last Service to the Republic," by George Ticknor Curtis; "Has the Southern Pulpit Failed?" by Rev. Dr. F. A. Shoup; "Caste at West Point, by P. S. Michie, Professor of Philosophy at West Point; and "Some Interesting Publications," by M. W. Hazeltine. This number closes the CXXXth volume and sixty-fifth year of the *Review*. During the last few years, this magazine has made a most remarkable advance in popular favor. Many of its numbers have passed through several editions, and its permanent circulation has increased more than six-fold. All the best papers of the country speak of it in the highest terms.

According to the astronomical notes from Vassar College observatory in the *Scientific American*, a large and densely black spot surrounded by the usual gray bordering and accompanied by others of smaller size, may be looked for early in June upon the eastern limb of the sun.

Good Company, for June, has its usual quota of good things, and in addition a very readable article by S. J. Douglass, on Science in High Latitudes, which, in view of the present interest felt in the second Howgate expedition, is very appropriate.

The *American Bookseller* says Winchell's Preadamites (S. C. Griggs & Co.) "is an elaborate and deeply interesting study of

ethnology, demonstrating the existence of men before Adam and making careful examination of their antiquity, conditions, peculiarities of race and distribution over the earth. While written in popular style, it is based upon scientific facts which are everywhere quoted to support the conclusions drawn, and history and literature as well are made to contribute to the writer's theories."

On looking over the Proceedings of the Academy of Science of Davenport, Iowa, now one of the most flourishing and notable societies in the west, we came across an account of the tenth anniversary of its establishment, at which "twenty-five persons were present." Quite encouraging to some of our own young Academy who feel discouraged when at an ordinary monthly meeting no more than fifty or sixty persons attend. The Davenport Academy is now nearly thirteen years old; it has its own building, a fine library and an extensive cabinet. Its publications, finely printed and illustrated in the best style of the art, would be creditable in every respect to any similar institution in the country.

The New York Daily *Graphic* says: The Kansas City REVIEW OF SCIENCE AND INDUSTRY (Kansas City, Mo., press of Ramsey, Millett & Hudson) for May is in several respects an advance upon many of its predecessors. The articles are all short and of unusual simplicity and readableness for a periodical of this kind. The table of contents includes five articles on geographical subjects, the two most important of them written for the REVIEW, viz: that on "Expeditions to the Arctic Sea," by Dr. John Rae, of London, and that on "The Second Howgate Expedition." The departments of Psychology, Physics, Philosophy and Meteorology contain original articles on appropriate topics. Professor F. W. Clarke's "Talk About Lightning" should be largely read, containing as it does knowledge needed by everybody. The "Scientific Miscellany" department is filled with carefully selected and interesting matter.

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